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The user-centred design of an educational toy for Foundation Phase learners to support the learning of an additional language, within the South African context.

FRANCIS GABRIELE BIRKENMAYER
201033455

Masters of Technology – Industrial Design

UNIVERSITY OF JOHANNESBURG
Faculty of Art, Design and Architecture

Supervisor: Victor dos Santos
Co-Supervisor: Professor Karen von Veh

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ABSTRACT

This study investigates the user-centred design of an educational toy for Foundation Phase learners to aid in the learning and teaching of an additional language. The study is conducted in the South African context and considers problems that arise from the dichotomy in the country’s socio-economic system and manifest in the education system. Secondary research shows that most Foundation Phase learners face a transition in their language of learning and teaching when entering the Intermediate Phase (from their mother tongue to English), and primary research shows that some learners receive instruction in English starting in the Foundation Phase, despite having no previous exposure to the language. The educational toy is primarily intended to support learner proficiency in the most prominent language of instruction (English), and approaches the problem from an industrial design perspective. Literature regarding education in South Africa, learning, and design for children was used to build a framework of understanding and to guide the research and design.

By combining the traditional design approach, user-centred design and the action research approach, the study conducts both primary and secondary research, and encompasses three design iterations that involved user feedback and testing at various stages. Although the learners are the apparent ‘users’ of the product, the role of teachers and facilitators is also crucial. The study was located at three schools and three remedial learning centres in Johannesburg, and involved primary and secondary users (learners and facilitators). The resultant design intervention is a set of language-based building blocks that focus on supporting the fundamentals of language learning. The open-ended resource consists of building blocks of various sizes (and a suitable storage system) that depict images, single letters and letter combinations, and that can be adapted to different learner levels and learning contexts, and can be used in a variety of ways.

Based on user feedback, as well as heuristic evaluations, this study can be considered successful in addressing the question of how the design of an educational toy can support the teaching and learning of an additional language in the Foundation Phase.

KEY WORDS

user-centred design; educational toy; assistive learning device; Foundation Phase education; language acquisition; learning through play.
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### List of Acronyms

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<th>Full Form</th>
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<tr>
<td>ANA</td>
<td>annual national assessment</td>
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<tr>
<td>BMI</td>
<td>body mass index</td>
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<td>C2005</td>
<td>Curriculum 2005</td>
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<td>CAPS</td>
<td>Curriculum and Assessment Policy Statements</td>
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<tr>
<td>CNE</td>
<td>Christian National Education</td>
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<tr>
<td>DBE</td>
<td>Department of Basic Education</td>
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<td>DOE</td>
<td>Department of Education</td>
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<td>ECD</td>
<td>early childhood development</td>
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<tr>
<td>ECOSOC</td>
<td>UN Economic &amp; Social Council</td>
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<tr>
<td>EFA</td>
<td>Education for All</td>
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<tr>
<td>FAL</td>
<td>First Additional Language</td>
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<tr>
<td>FET</td>
<td>Further Education and Training</td>
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<tr>
<td>FP</td>
<td>Foundation Phase</td>
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<td>GEM</td>
<td>global education monitoring</td>
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<td>HL</td>
<td>Home Language</td>
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<td>ICSID</td>
<td>International Council of Societies of Industrial Design</td>
</tr>
<tr>
<td>ICT</td>
<td>information and communications technology</td>
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<tr>
<td>IIAL</td>
<td>incremental introduction of African languages</td>
</tr>
<tr>
<td>LIEP</td>
<td>Language in Education Policy</td>
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<tr>
<td>LOLT</td>
<td>Language of learning and teaching</td>
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<tr>
<td>LSEN</td>
<td>learners with special educational needs</td>
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<tr>
<td>LTSM</td>
<td>learning and teaching support and material</td>
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<tr>
<td>NCLD</td>
<td>National Centre for Learning Disabilities</td>
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<td>NDP</td>
<td>National Development Plan</td>
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<tr>
<td>NGO</td>
<td>non-governmental organisation</td>
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<td>NSC</td>
<td>National Senior Certificate</td>
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<tr>
<td>OBE</td>
<td>outcomes-based education</td>
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<tr>
<td>RNCS</td>
<td>Revised National Curriculum Statement</td>
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<tr>
<td>SA</td>
<td>South Africa / South African</td>
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<td>SAIIRR</td>
<td>SA Institute of Race Relations</td>
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<tr>
<td>SAL</td>
<td>Second Additional Language</td>
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<td>StatsSA</td>
<td>Statistics SA</td>
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<tr>
<td>TEFL</td>
<td>teaching English as a foreign language</td>
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<tr>
<td>UCD</td>
<td>user-centred design</td>
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<td>UI</td>
<td>user interface</td>
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<tr>
<td>UN</td>
<td>United Nations</td>
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<td>Acronym</td>
<td>Full Name</td>
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<tr>
<td>UNESCO</td>
<td>UN Educational, Scientific &amp; Cultural Organisation</td>
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<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
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<td>USCPSC</td>
<td>U.S. Consumer Product Safety Commission</td>
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<td>WDO</td>
<td>World Design Organisation</td>
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<tr>
<td>Code</td>
<td>Definition</td>
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<tr>
<td>C</td>
<td>Concept</td>
</tr>
<tr>
<td>DI</td>
<td>Design Intervention</td>
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<tr>
<td>DP</td>
<td>Developed Product</td>
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<tr>
<td>E</td>
<td>Expert (Key Informant)</td>
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<tr>
<td>EF</td>
<td>Expert Facilitator</td>
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<td>H</td>
<td>Head</td>
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<tr>
<td>LC</td>
<td>Learning Centre</td>
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<tr>
<td>LG</td>
<td>Learner Group</td>
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<tr>
<td>RP</td>
<td>Refined Product</td>
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<tr>
<td>S</td>
<td>School</td>
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<tr>
<td>SL</td>
<td>Single Learner</td>
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<td>TF</td>
<td>Typical Facilitator</td>
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<td>VF</td>
<td>Volunteer Facilitator</td>
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CHAPTER 1 – INTRODUCTION

1.1 STUDY TITLE ___________________________________________________

1.1.1 LONG TITLE
The user-centred design of an educational toy for Foundation Phase learners to support the learning of an additional language, within the South African context.

1.1.2 SHORT TITLE
Design of an educational toy to support language learning.

1.2 CONTEXTUALISATION OF RESEARCH__________________________________

To understand the significance of this study, one needs to understand the context within which the problem statement falls. Prior to defining the problem statement, this section builds a framework of understanding that aids in the appreciation of the necessity and purpose of the research study and the resultant design intervention. The contextualisation section starts with a broad introduction to the research; identifying the gaps in education aids in contextualising the international call for attention to the plight of children and the importance of their education, and it helps to gauge South Africa’s (SA’s) position in this global scope. This is followed by a background to the study that covers the history of education and curriculum reform in SA, both of which had a significant impact on the current educational landscape. In order to develop the framework of understanding, the next section discusses aspects that need to be considered in this study, including Foundation Phase (FP) education, literacy, the Language in Education Policy (LIEP), and the preference for the use of English in education. This is followed by the core of the contextualisation section that defines the SA context, as it is referred to in the title of this study. The following aspects are discussed: the inequality of academic achievement that can be directly linked to the societal divide and the poverty gap; school attendance and the current state of education in SA; the impact of poverty on education and achievement; and finally, the role of language and how it is affected by poverty. This section concludes by delineating the significance of this research and looks at breaking the cycle of poverty and the importance of learning an additional language, before closing with a motivation for the research and design intervention.
Brahm Fleisch’s book, *Primary Education in Crisis* (2008), is referred to throughout this section. In his book, Fleisch discusses post-1994 education in SA and the reasons why SA schoolchildren underachieve in reading and mathematics. By looking at SA’s political past, Fleisch draws attention to the evident racial segregation that has caused a rift among the population in terms of wealth distribution, healthcare, access to infrastructure, and – especially – education. Fleisch (2008) analyses multiple research studies and academic articles that address the various factors that contribute to the educational crisis. Using this data, he draws logical conclusions by comparing results from studies in different disciplines. Throughout his book, and by using interdisciplinary analyses, Fleisch focuses on how children’s lives outside the classroom affect how they perform inside the classroom, which is a key contributor to understanding the SA context.

1.2.1 INTRODUCTION TO THE RESEARCH

The *Universal Declaration of Human Rights* (1948), which was adopted by United Nations (UN) General Assembly in 1948, recognises education as a basic human right (Article 26). In addition to supporting the acquisition of skills and knowledge that allows for the cultivation of civil society and democracy, education also allows people to be better informed with regard to using health services, to ensure that their own children are well educated, and to acquire the skills that are required to lift themselves out of poverty (Department of Basic Education (DBE) 2014a:14). Education is not only a fundamental human right, but it “[is] essential for the exercise of all other human rights”, and depriving children of an education inhibits individual freedom, personal empowerment and developmental benefits (INDEX 2013). Although there have been significant improvements in ensuring that the rights of children are upheld, economic disparities and widening gaps are still experienced, particularly in developing nations (Heymann 2014; United Nations Children’s Fund (UNICEF) 2014a:7). Regardless of the international efforts that have been made, there are still millions of children who face malnutrition, death from preventable causes, exposure to extreme poverty, and a “chronically deficient” quality of education, where 38% of primary school children globally are not learning the fundamentals of literacy and numeracy (UNICEF 2014a:11–24).

According to the United Nations Economic and Social Council (ECOSOC) (2016:7) there were 59 million children out of school in 2013; 30 million of which were in sub-Saharan Africa (Humanium [sa]; UNICEF 2014c). Humanium (an NGO focusing on children’s rights, especially in poor countries) refers to the concept of ‘educational poverty’, which signifies that a child has spent less than four

\[\text{\textsuperscript{1}}\text{Fleisch is a professor in the Department of Educational Leadership and Policy Studies at the University of the Witwatersrand.}\]
\[\text{\textsuperscript{2}}\text{Through global action and sustained political commitment the mortality rate of children under the age of 5 has been reduced by half, school enrolment globally is on the rise, polio has nearly been eradicated, and children have improved access to education, sanitation, water and nutrition, in comparison to 1990 (Heymann 2014; UNICEF 2014a:2,11,17).}\]

2
years in school\(^3\) (extreme educational poverty signifies that a child has spent less than two years in school). By this definition, more than half the children in sub-Saharan Africa suffer from educational poverty, and resultanty 759 million adults are illiterate and do not have the awareness needed to improve either their own living conditions or those of their children (Humanium [sa]). One of the UN's Millennium Development Goals, set in 2000, was universal primary education by 2015, however, this goal was not reached in time and, upon review, the UN launched the Sustainable Development Goals in 2015, of which Goal 4 aims to “ensure inclusive and equitable quality education and promote lifelong opportunities for all” (ECOSOC 2016:7; United Nation’s Educational, Scientific and Cultural Organisation (UNESCO) 2014:1). The Right to Education Project (2013) notes that the right to education refers not only to free access, but also to competent education that upholds international standards. Irina Bokova (2014:i), director-general of UNESCO, also points out that “[a]ccess is not the only crisis”, and that poor-quality education negatively impacts even those who do have access. Bokova (2014:i) further warns that an “education system is only as good as its teachers”, but that teachers need the support of training programs, and well-designed curricula and assessment strategies in order to provide quality education.

The Education for All (EFA) movement, established in 2000 and also coordinated by UNESCO, aims to implement universal primary education, but also wants to ensure that education is globally accessible in a learner’s first language; on the basis that this increases access to education, reduces the chances of grade repetition, improves a child’s self-confidence, encourages greater parental involvement, and positively impacts on learning across the curriculum, (UNESCO 2016:29; World Bank 2005:2–3). This is echoed by the 2016 Global Education Monitoring (GEM) Report\(^4\), which emphasises the importance of children learning in a language they understand – preferably the mother tongue – for the duration of their primary schooling (UNESCO 2016:29). To achieve this, UNESCO (2014:33) promotes a bilingual approach throughout primary schools, which “combines continued teaching in a child’s mother tongue [alongside] the introduction of a second language”. UNESCO (2014:34) also states that to ensure success with such bilingual education, relevant learning support material needs to be readily available in both languages, and that this material needs to be adequately used (in both home and educational environments).

Anthony Lake (2014:5), executive director of UNICEF, states that an investment in a child’s education is an investment in their future, since it starts “a path towards prosperity, empowerment and inclusion, not just for the individual, but also for societies and economies”. It is important to

\(^3\) Those children who do not attend school are likely to be working (possibly to support their families), to be starting their own families, to be restricted by a disability, to be involved in conflict areas as child soldiers, or to have no support – financial or otherwise – from their family and community to attend school (UNICEF 2014a; Leadbeater & Wong 2010:iv).

\(^4\) Which reports on the global progress towards reaching the UN's Sustainable Development Goal 4.
remember that education is a human right, not a privilege, and that making education accessible to all is the keystone to a country's future. As mentioned before, achieving universal education is not only about access and attendance, but also about the quality of education that children receive and ensuring that education is available in a language that children understand.

1.2.2 BACKGROUND TO THE STUDY

The first aspect of contextualisation requires an overview of education in SA, which includes looking at the history of education in the country, and the impact of curriculum reform on education as it stands now. A summary of SA's political and educational background supports the understanding of historically based reasons for the current state of education in the country. Even though the SA Constitution states that “everyone has the right to a basic education” (South Africa 1996b:20), the World Economic Forum's Global Competitiveness Report for 2016/2017 ranked the quality of SA's primary education at 126th out of 138 countries (with the quality of the higher education system ranked at 134 and the quality of maths and science education ranked at 138th) (Schwab 2016:325). This shows that the SA government appears to be unable to uphold its constitutional responsibility of providing access to competent education. This inadequate performance on the global scale does not bode well for the future of the SA youth, and the World Economic Forum warns that SA is likely to see “reductions in their future human capital” as a result of their education system (Schwab 2016:57). It is necessary to understand how the policies from past governance have had an enduring effect, to recognise the current government's failure to rectify these shortcomings, and to subsequently see how this reflects on education and learner achievement.

1.2.2.1 HISTORY OF EDUCATION IN SOUTH AFRICA

There has long been political tension and inequality in SA, and education has often been used as a tool to incite this. The National Party's rise to power during the 1940s marked the beginning of apartheid, and heightened the level and extent of racial segregation. In 1953 the educational landscape was restructured with the implementation of the Bantu Education Act (No. 47 of 1953), which ensured that black education remained inferior to its white counterpart and "widened the gaps in educational opportunities" (Ocampo 2004). The Christian National Education (CNE) system believed that "a person's social responsibilities and political opportunities are defined by that person's ethnic identity", and although it promoted cultural diversity, and mother tongue instruction became

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5 This section only highlights historical points that are pertinent to the scope of this study, but for a comprehensive overview of the history of education in SA, please refer to Appendix A.
6 It must be noted that while the ranking of the quality of SA's primary education has improved marginally relative to its 133rd position in 2013 (out of 148 countries), the quality of the higher education, and the quality of maths and science education have remained dismal, ranking at 146th and 148th place respectively in 2013 (Schwab 2016:347).
7 The core curriculum and guiding philosophy for education during apartheid.
compulsory for the first years of primary education, it did so in order to “[advance the] principles of racial inferiority” (Ocampo 2004; Federal Research Division 1996). Although recent research shows the advantages of mother tongue instruction, the apartheid government implemented mother tongue instruction with the purpose of “reducing the horizons of Africans, cramping them intellectually within the narrow bounds of tribal society, and diminishing the opportunity of inter-communication between the African groups themselves and also with the wider world of which they form a part” (Troup cited by Blumfield 2008:11). By the 1970s the government was spending significantly more on ‘white’ education, and this was evident in the ‘black’ schools’ inferior resources, such as out-dated infrastructure, overcrowded classrooms and textbook shortages (Ocampo 2004).

Following the aftermath of the 1976 student uprisings in Soweto\(^8\), international solidarity movements put pressure on the SA government to reform. Schools were allowed to choose their own medium of instruction, and more schools and teacher training facilities were built in the townships (Davie 2006:1). The reconciliation negotiations that started in 1986 finally led to the narrowing of the spending gap between racial groups (Unterhalter cited by Blumfield 2008:17). The apartheid laws started to be lifted in the 1990s and the restructuring of the education system needed to be non-racial, yet still provide “enough flexibility to allow communities to preserve their religious and cultural values and their home language” (Federal Research Division 1996). In 1993 President FW De Klerk gathered leading experts on education to help formulate the new education framework, and parents were allowed to choose the medium in which their children were instructed – however, the matter of African language instruction was not addressed, and English and Afrikaans still dominated (Sedibe cited by Blumfield 2008:18; Ocampo 2004; Federal Research Division 1996). There had also not been enough time or funding to provide a sufficient number of schools and teachers for the school-age population when schools reopened in January 1995, and even by 1996 racial neutrality in terms of education had not been achieved (SA Institute of Race Relations (SAIRR) and Abdi cited by Blumfield 2008:19; Ocampo 2004; Federal Research Division 1996). The government has been attempting to correct these failings ever since, with varying degrees of success.

1.2.2.2 CURRICULUM REFORM

Since the end of apartheid, the SA education policy has seen the introduction of three different revision–development–implementation cycles. These revisions typically include relooking at school access, governance, curriculum, teacher training and resource distribution (Zenex Foundation 2013). The first change to the education policy and curriculum was implemented in 1997, and was the SA government’s version of outcomes-based education (OBE). Even though the previous

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\(^8\)Black students in Soweto were protesting against being taught in Afrikaans; a language that not even their teachers spoke fluently (Boddy-Evans 2001:1). This new ruling was enforced for a number of reasons, one being that the Afrikaner government feared that the introduction of television in SA would “strengthen the position and status of English in the country” (Bonner & Segal cited by Davie 2006:1).
education system was not without fault, it had nonetheless been relatively successful and reputable. However, instead of keeping what was good about the existing system and building on it, the new government discarded all familiar principles of education in favour of OBE – an approach that was considered controversial world-wide, as it had failed in some developed countries, and the countries where it had been implemented successfully were vastly different from SA (Louw, Mouton & Strydom 2012:1211,1214).

The outcomes-based approach to schooling, which resulted in Curriculum 2005 (C2005), promised to deliver results and academic success by allowing learners and teachers to work at their own pace through a framework that was open, non-prescriptive and did not rely on government-issue learning programmes and support material – instead it aimed at empowering teachers by encouraging them to develop their own class plans and learning materials based on the prescribed guidelines (Zenex Foundation 2013; Chisholm 2003:3). Although this initiative was sound in theory, many teachers were ill-prepared for taking on such a responsibility, and as a result, support materials – if available – were of an inconsistent standard, and were not sufficiently used (Chisholm 2003:3–4). The government’s aim with C2005 was to achieve transformational ‘social justice’ – a fair and uniform chance at education for children who had been disadvantaged by the education policies of past governance (Louw et al. 2012:1213). However, instead of creating a more equal society, C2005 resulted in “widespread ignorance” as the curriculum moved away from the fundamentals of literacy and numeracy, and it essentially resulted in widening the performance gap instead of closing it (Louw et al. 2012:1211; Fleisch 2008:137).

C2005 was a highly confusing, time-consuming, and administratively bureaucratic system, and by 2006 it was evident that this system had failed and it was amended (Naidoo 2011:1; Lungu cited by Blumfield 2008:19). This new policy was called the Revised National Curriculum Statement (RNCS) and was implemented between 2004 and 2008 (Louw et al. 2012:1211). Although the RNCS was seen as an improvement on C2005, it was a major shift in the education policy and required significant funding and resources to allow for implementation (Maluleka 2015). The RNCS simplified teaching and learning-outcome statements and placed greater emphasis on “basic skills, content knowledge and grade progression” (DBE 2015b; Zenex Foundation 2013). Some of the core values of OBE, such as the principle of progressing at one’s own pace, were no longer prioritised (Louw et al. 2012:1215).

In 2010 the newly established DBE announced yet another review of the SA education policy that was intended to strengthen the RNCS in order to improve the quality of teaching and learning. This was implemented between 2012 and 2014, and the most notable amendment was the introduction of the teaching of an additional language starting in Grade 1 (with preference given to English) (Louw et al. 2012:1215; DBE 2011e:11). The latest education review is called the Curriculum and
Assessment Policy Statements (CAPS). It is not a new curriculum in itself, but an amendment to the RNCS which makes the curriculum more accessible to teachers⁹ (Coetzee, cited by UNISA 2012). CAPS (which is currently implemented) is more regulated and allows more time for studying literacy and numeracy – the fundamentals of education (Zenex Foundation 2013).

If the implementation of curriculum reform is rushed, it is bound to fail, as the politics tend to overshadow the pedagogy, and since the SA education system has seen three new iterations in under 20 years, it is evident that, regardless of their faults, these policies were not given sufficient time to be fully adopted and suitably adapted (Zenex Foundation 2013; Louw et al. 2012:1211). Furthermore, rushed curriculum reform inevitably has an adverse effect on learning and teaching, which reflects in learner achievement. The roll-out of CAPS in addition to the RNCS was only fully implemented in 2014, so deeming it a success or failure would be pre-emptive and naïve.

1.2.3 IMPORTANT FACTORS

There are several important factors that need to be delineated in order to fully appreciate the necessity of the proposed design intervention. Policies regarding the use of language in education can be a source of contention, especially when one or two languages are imposed as the language of instruction in multiethnic countries – as is the case in SA (UNESCO 2016:104). However, the language of learning and teaching (LOLT) in the classroom is crucial as it forms the basis of how children learn and how teachers teach. FP educators are responsible for ensuring that language is used and taught adequately throughout this phase of education, and that it is integrated effectively within each subject (DOE 2003:21). As such, this section briefly discusses the importance of the FP and literacy, whereafter it outlines the SA Language in Education Policy (LIEP), and the necessity of English in its capacity as a global language. Language lies at the crux of the design intervention, as the use of language(s), especially in teaching, is exceptionally important due to its role in facilitating all other learning; as the DOE (2003:21) states, “without language, no other learning can exist”.

1.2.3.1 THE IMPORTANCE OF FOUNDATION PHASE EDUCATION

This study focuses on the design and development of a product in the field of education, more particularly, FP education. The FP is part of the primary education sector¹⁰ and takes place from Grade R to Grade 3 (typically ages 6–9, but can range from 5–10). It focuses on laying the foundation

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⁹ It is important to note that both the RNCS and CAPS revisions were merely adjustments to the curriculum (what is taught) and not the teaching methods (how it is taught), which means that some of the fundamental principles of outcomes-based education are still relevant (Du Plessis 2013:1).

¹⁰ The SA education system is divided into three tiers, namely primary, secondary and tertiary education (pre-primary school also forms part of the system, however at the time of writing this has not been made compulsory). This system is further divided into phases: Early Childhood Development (ECD) (pre-grade R), FP (grades R–3), Intermediate Phase (grades 4–6), Senior Phase (grades 7–9), Further Education and Training (FET) (grades 10–12) and Higher Education (universities).
for further learning by teaching four subjects: Home Language (HL), First Additional Language (FAL), Mathematics and Life Skills. The FP is considered critical in a child’s upbringing, because these are the years during which “a child learns fundamental competencies that will enable him or her to learn and to develop a clear conception of the world” (Pandor 2008). The Minister of Basic Education, Angie Motshekga (2015b), also emphasises early education as “the most powerful investment in human capital that a country can make”, and elaborates that early education is “critical for the acquisition of skills and concepts [that will lay] the foundation for lifelong learning”.

What children are exposed to during this time in their lives influences their physical health, emotional well-being, basic learning, academic success, and “economic and social participation” (UNICEF 2014a:21). It is during this phase of education that children become more familiar with and more adept in the use of “sounds, words and language, [to] create and interpret texts”, which means that this is the time during which children are at their prime to develop literacy skills (DOE 2003:21–22). It is also during this time that teachers can identify any needs or weaknesses that learners might have, and remediate these problems before a more rigorous curriculum is imposed.

Even though this level of schooling is compulsory, children from underprivileged backgrounds sometimes fail to attend or complete their primary school education due to financial reasons, isolation from schools, poor health, or decisions made by parents (Leadbeater & Wong 2010:iv; Ramdass 2009:115). It is, however, crucial for children to achieve this level of education, as they need to be prepared for the remainder of their education and – in the long run – for the world of work (Ramdass 2009:117). If a child does not master the basic skills and concepts that are taught during this phase of education, they will be at a disadvantage throughout their schooling, as each grade and phase builds upon the knowledge attained from the previous years (Gustafsson, Kotzé, Spaull, Van der Berg & Wills 2016:10; Spaull 2016:1).

1.2.3.2 THE IMPORTANCE OF LITERACY

Education, and more specifically literacy and numeracy, affords people the skills required to lift themselves out of poverty (DBE 2014a:14). Furthermore, being well educated entitles people to higher wages, which helps the economic growth of the country (DBE 2014a:14). Mark de Vos and Kristin van der Merwe (2013) believe that “[l]iteracy is probably the single most important skill for the individual and society at large [as] [i]t is an empowerment tool that gives access to further education and life opportunities”. Furthermore, Gustafsson et al. (2016:6) state that literacy is “central to the ability to learn and therefore a prerequisite to progress successfully through the education system”, and that, as such, learning to read (in both the home and additional languages) should be the unifying goal of primary education starting in the FP (Gustafsson et al. 2016:10; Jackson, McKay, Murray, Pretorius & Spaull 2016:2). The education level of a parent can be used as an indicator for their child’s education, and receiving a good education can have a “cumulative positive effect for each
subsequent generation” (DBE 2014a:14; Hall 2014:109). The ability to read, write, count and calculate is "a central component of the economy, transformative democracy and an individual’s life competencies", which is why mastering these abilities at an early age is a crucial investment in a learner’s future (De Vos & Van der Merwe 2013).

It is important that basic literacy skills are developed early in a child’s academic life, since these are fundamental to facilitating all other learning (Gustafsson et al. 2016:15; Spaull 2016:1; DBE 2011b:10). The necessity of literacy expands beyond academic competence, as it is also “linked to personal empowerment and is essential for social and cultural interaction” (DOE 2003:49). This extends to both the home and additional languages. Literacy essentially enables cognitive development through the use of language to communicate thoughts, ideas, feelings and experiences (DOE 2003:49). The development of language skills enables creative, critical and reflective thinking while also encouraging the processing and communication of information (DOE 2003:28). The language learning process can be used as a tool to discuss important social issues and as a means of encouraging tolerance of others in a diverse society (DOE 2003:49). Tolerance and acceptance of others in society is further supported by the teaching of an additional language which encourages “mutual understanding” and advocates the multilingual identity of the SA community (DOE 1997:1,74–75).

1.2.3.3 THE LANGUAGE IN EDUCATION POLICY

The SA Language in Education Policy (LIEP) (1997) states that “being multilingual should be a defining characteristic of being South African” in order to “counter any particularistic ethnic chauvinism or separatism through mutual understanding” (DOE 1997:1). In accordance with this, the DBE’s language curriculum throughout all school phases supports the concept of additive bilingualism, which means that students learn an additional language while simultaneously “maintaining and developing" their home language. This means that children should be able to extend the knowledge they have of their home language to the learning of an additional language, as well as to academic contexts taught in an additional language (Taylor & Von Fintel, cited by Gustafsson et al. 2016:15; Fleisch 2008:105; DOE 2003:21–22). Although additive bilingualism is considered the optimal approach for teaching multiple languages in the SA context (Hoadley 2016:36), shifting from using the home language to an additional language too soon means that the development of the home language is hampered, and that the child is deprived of the chance to master basic concepts in a language that they comprehend, which may prevent them from transferring this understanding to an additional language (Essien, cited by Dale-Jones 2013; DBE

11 Sometimes referred to as a person’s ‘second language’.
12 The language that is spoken most frequently at home and is used for thought and communication (DBE 2010:3). Sometimes referred to as a person’s ‘first language’.
The problems that stem from premature language transition also manifest themselves in the study of other subjects, such as mathematics and science, especially in later years (Essien cited by Dale-Jones 2013).

As such, the LIEP indicates that the LOLT offered by a school should reflect the majority of learners’ home language for the duration of the FP when children are still learning the basics of linguistics (DBE 2010:6; DOE 2003:21–22). Thus, FP education is offered in all 11 official SA languages. In addition to teaching the home language, the CAPS curriculum amendment stipulates that, starting in Grade 1, the teaching of an additional language is also compulsory. This is the government’s way of making provision for the rich linguistic and cultural diversity that exists in the country (DOE 2003:20).

Even though the SA constitution affords children the right to access all phases of education in the language of their choice, this right is hampered by the government’s inability to provide this facility (DBE 2010:6). Due to this, the LOLTs are officially limited to English and Afrikaans from the Intermediate Phase (IP) onwards. In order to aid the transition from the home language to – predominantly – English instruction when learners enter Grade 4, curriculum regulations state that if the LOLT in the FP differs from the LOLT offered from the IP onwards, then the language that is offered as the First Additional Language (FAL) in the FP must be the same as the LOLT for the IP (DBE 2012b:10). Thus, the language that is offered most extensively at FAL level to non-English speaking learners throughout the FP should be English.

13 The language medium used for all teaching, learning and assessment, and the language in which all non-language classes are conducted (DBE 2010:3).
14 The LOLT offered by a school is largely dependent on the community it serves, as well as what is requested by the learners and parents, although this can be influenced by decisions made by the relevant school governing body (DBE 2010:7). Provided a minimum of 40 learners request to be taught in a language that their chosen school does not offer, the school is obligated to make provisions for these students (DBE 2010:7).
15 This aligns with the 2016 Global Education Monitoring (GEM) policy recommendations, which advocate mother tongue instruction, and ensuring that teachers are trained to teach in these languages (UNESCO 2016:164–166).
16 Afrikaans, English, isiNdebele, isiXhosa, isiZulu, Sepedi, Sesotho, Setswana, Siswati, Tshivenda, and Xitsonga.
17 Even though Afrikaans is formally recognised as a LOTL for schooling beyond the FP, at only 13% it is the minority of schools that offer Afrikaans medium tuition (DBE 2010:16–17). For the purpose of simplicity this study refers to English as the prevailing language of tuition.
18 It must also be noted that even though English and Afrikaans are the only LOLTs that are offered from Grade 4 onwards, this does not necessarily mean that learners are taking English or Afrikaans at the Home Language level upon entering the Intermediate Phase. They may still be taking their FP LOLT at HL level (if this was not Afrikaans or English) and they may only be taking English or Afrikaans at FAL level. In order to complete the National Senior Certificate (NSC), learners must take two language subjects, one of which has to be taken at HL level. One of these languages also has to be the LOLT, however, the LOLT does not have to be the language taken at HL level. The subject taken at HL level could thus be any of the official African languages. All other subjects are nevertheless only offered in English or Afrikaans, yet due to the structure of the curriculum students do not necessarily benefit from strengthening this language by taking it at HL level.
1.2.3.4 **English as the Preferred Language**

The extensive use of English as the preferred LOLT from the IP onwards may be governed by law, but it is also driven by a combination of parental preference, tradition and practicality\(^{19}\) (DBE 2010:22). English is a global language and, in the SA environment, it is the most prevalent language in the workplace and the public sector. It is also useful for tertiary education which is predominantly offered in English (DBE 2010:22). English is generally seen as an enabler for upwards social mobility, and as such most parents insist that their children be educated in English rather than the mother tongue (Hoadley 2016:37; DBE 2010:22; Foley 2010:14). African children who are from the “new black middle class” are also typically introduced to English in the home environment from an early age, as their parents see the value of being proficient in English (Fleisch 2008:118–119). In the past, language has been used as a mechanism for social control, however, English has always been considered a language of status and economic power, and is associated with better academic performance, whereas African languages have in some cases become stigmatised and may have particular class values attached to them (this includes Afrikaans, to an extent, due to its association with the National Party) (Foley 2010:6; Braam, cited by Fleisch 2008:112). English is indispensable in the current SA context, and the necessity for African-language learners, as well as Afrikaans-speaking learners, to learn English cannot be ignored. Therefore, learners need to reach a high level of competency in English at the FAL level (in terms of comprehension, reading and writing) by the time they exit the FP in order to adapt easily to the teaching of other subjects upon entering the IP (DBE 2011a:8).

1.2.4 **Defining the South African Context**

To fully understand not only the intention, but also the significance of this research study, it is imperative to understand what is meant by ‘the South African context’ as it is referred to in the study title. Even though apartheid was abolished more than two decades ago, there is still a noticeable lack of unity and equality in the SA society and this filters through to the quality of education that is offered. To a large extent, this can be attributed to factors that were inherited from apartheid policies. To provide the necessary background to understanding the current SA context, this section

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\(^{19}\) It has been suggested that all subjects and curricula from Grade 4 to Matric (or at least to Grade 7) should be translated and offered in all nine official African languages, as is done in the FP. This process would involve standardising and developing the nine languages so they are able to carry academic discourse effectively, whereafter the curricula would need to be translated, teachers would need to be trained, and an implementation strategy would need to be researched (Foley 2010:3–12). This would be an enormous and expensive undertaking, and if the government were to implement a mother tongue instruction policy, it would force primary schools – and learners – to be divided into language groupings that would echo a form of “linguistic apartheid”, which could have dire consequences (Foley 2010:14). Notably, the implementation of mother tongue instruction during apartheid was, ultimately, introduced in order to encourage racial segregation (Troup cited by Blumfield 2008:11). Murray (cited by Hoadley 2016:37) further warns that debate around language of instruction deflects attention from more pressing issues such as the quality and quantity of extant instruction, irrespective of language.
commences with an overview of the bimodal distribution of academic achievement, and how this is linked to a societal divide that is apparent throughout the country. This leads on to a brief mention of the statistics regarding school attendance in SA, and a summary of the current state of education in SA. Following this, the next section investigates the impact of poverty on education and achievement, as well as the role of language and how it can be affected by poverty; both of which are central factors in defining ‘the SA context’ as it is referred to in this study. This context – which focuses on unequal achievement and poverty due to unresolved issues from the past, and how this affects language use in SA education – needs to be considered alongside the background to the study and the important factors that have previously been delineated.

### 1.2.4.1 A BIMODAL DISTRIBUTION IN A DIVIDED NATION

In his book *Primary Education in Crisis* (2008), Brahm Fleisch (2008:v,1–30) identifies and describes a “bimodal distribution” of achievement, which characterises the achievement levels across SA primary schools. Former President Thabo Mbeki’s (1998) ‘two nations’ thesis, which was developed during a political debate in 1998, echoes the theory of a bimodal distribution being present in SA. This nationwide split occurred not only during, but also as a result of, apartheid (Fleisch 2008:1). Mbeki’s theory is summarised as follows:

> ... the material conditions in our society ... have divided our country into two nations, the one black, the other white. ... [the latter is] relatively prosperous ... [and] has ready access to a developed economic, physical, educational, communication and other infrastructure. ... The second and larger nation of South Africa is black and poor ... [and] lives under conditions of a grossly underdeveloped ... infrastructure ... [and as a result] it has virtually no possibility to exercise ... [its] right to equal opportunity.

Mbeki (2003) elaborated on this theory in his ‘Letter from the President’, where he refers to SA as being split into two nations – differentiated based on their economies:

> ... [in the context of poverty it has been] observed that our country is characterised by two parallel economies, the First and the Second. The First Economy is modern, produces the bulk of our country's wealth, and is integrated within the global economy. The Second Economy (or the Marginalised Economy) is characterised by underdevelopment, contributes little to the GDP, contains a big percentage of our population, incorporates the poorest of our rural and urban poor, is structurally disconnected from both the First and the global economy, and is incapable of self-generated growth and development.

Using the former President’s metaphor, Fleisch (2008:1) reasons that SA similarly has two education ‘systems’ – the ‘first’ serves predominantly upper- and middle-class children (from all race groups) and the ‘second’ caters to overwhelmingly poor black children. If, theoretically, the average achievement of all SA primary school learners was plotted on a graph, two peaks would occur in the

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20 When statistical data is represented graphically, a bimodal distribution refers to two peaks occurring within the data and typically indicates that one is dealing with two different groups that are being measured against a common axis (Statistics How To 2013).
data as in Figure 1. The first peak would reflect the lower-than-average performance of the majority of schoolchildren – the 70% to 80% of students who are predominantly from disadvantaged (former black) schools and battle with reading in the language of instruction and have a limited understanding of numeracy. The second peak would represent the better-performing minority of children – the remaining 20% to 30% of students who are from both black and white middle-class families and attend (historically advantaged, or private) schools that have access to better resources. This minority has greater proficiency in reading and mathematics, and their achievement levels are comparable to that of developed nations, such as Germany or the United States\(^\text{21}\) (Fleisch 2008:v,3).

The idea of two separate schooling systems existing within the SA educational framework is echoed by Martin Gustafsson (2005:12) and Nicholas Spaull (2012). According to Gustafsson (2005:12), these are directly linked to historically disadvantaged and historically advantaged schools, but Spaull (2012) elaborates on this and shows that the bimodal distribution of achievement can also be characterised by differences in language, income, ethnicity and socio-economic status. Some of these disparities can be attributed to remnants of apartheid ideologies and the Bantu Education policy, but essentially privileged children – whose parents can afford to spend more on school fees – have the advantage of attending better schools, receiving a better education (due to access to better resources), and achieving better results, than their socio-economically disadvantaged counterparts (Department of Education (DOE) 2009:2; Ramdass 2009:111; Fleisch 2008:95). These privileged children then attend higher education, get high-paying jobs, and are able to provide the same for their own children, whereas their socio-economically disadvantaged counterparts are doomed to “fill the ranks of the unemployed, the informal sector, or become part of the second-tier

\(^{21}\) This second peak also includes the results of the few talented learners who attend disadvantaged schools and outperform their peers despite their more challenging circumstances.
labour-market which offers low-productivity jobs and low incomes” (Spaull 2012). As a result of this, the academic achievement gap in our education system is perpetuated by consistent under-achievement in disadvantaged (former black) schools, which have the compound adversity of fewer resources, and serving underprivileged communities. It can thus be deduced that unequal education (the achievement gap) is directly linked to the unequal socio-economic background of learners (the poverty gap) in a cycle that is very difficult to break, as the one perpetuates the other (Figure 2) (Spaull 2012; Fleisch 2008:76,79).

**Figure 2:** Representation of how the patterns of poverty and privilege are linked to education and achievement. (Spaull 2012)

### 1.2.4.2 School Attendance

Recent statistics show that just under 10.9 million children (as of 2013) attend the 23 562 schools (as of 2015) in SA (Davis 2015; De Lannoy & Hall 2015). This equates to over 97% of SA children attending the compulsory phases of schooling, and 99.3% of children attending compulsory primary schooling (DBE 2014a:14; Hall 2014:104). However, high rates of school attendance unfortunately do not reflect the quality of education received, nor does it reflect the learners' progress through the phases (Hall 2014:106). High attendance rates in the FP do, however, provide a good opportunity for an educational intervention, as it means that “almost all children in an age cohort can be reached at a particularly important developmental stage” provided that adequate measures and services are in place (Hall 2014:106). It is this opportunity on which this research study hopes to capitalise.

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22 Even though almost 100% of children are enrolled in the FP, of this group, only 85% was passing the FP exit grade ‘on time’ (Hall 2014:108).
1.2.4.3 The Current State of Education

Despite the government’s efforts to reform the SA education system, it is still considered a “high-cost, low-performance” system, and inequality in the classrooms can still be seen in terms of the quality and quantity of teachers, access to resources (textbooks, stationary, internet access), infrastructure (school buildings, toilets, access to schools), and teacher-to-learner ratio (Gustafsson et al. 2016:14; DOE 2009:1; Ramdass 2009:111; Fleisch 2008:83). Furthermore, because of the “enduring legacy of Bantu Education”, Fleisch (2008:vi,30) found that “learning remains context-bound and non-generalisable” which leads to a lack of basic understanding (Hoadley 2016:51).

SA learners take regional, national and international tests in order to assess their capabilities, and the subsequent analyses tend to show an “underlying pattern of unequal achievement” and show that the overwhelming majority of primary school children fail to reach a desirable level of proficiency in reading and mathematics (Fleisch 2008:12). The latest statistics regarding the performance of SA learners can be gleaned from the 2014 Annual National Assessment \(^{23}\) (ANA) results, and although the findings may appear promising, analysis of these results show that many students are still not performing at the required levels, and that the achievement and poverty gaps are still linked \(^{24}\). The ANA provides a statistical breakdown of performance in relation to the LOLT, which is of interest to this study. When it comes to performance in the Home Language, FP learners tend to perform reasonably well (from grades 1–3 the average marks are generally above 50%), and this can be attributed to the LOLT primarily aligning with the HL. However, when looking at performance across grades in 2014, achievement in both HL and FAL subjects tends to show a steady decline as learners progress. Where 66% of learners obtain acceptable achievement (50% or more) for the HL subject in the FP, only 48% of learners obtain the same in Grade 9. Similarly, 42% of Grade 6 learners obtain acceptable achievement for the FAL subject, but a mere 18% of learners achieve the same in Grade 9 \(^{25}\) (DBE 2014b:9,42–45,91).

These results can, in part, be attributed to the departure from mother tongue instruction from Grade 4 onwards. However, the link between the departure from mother tongue instruction and English

\(^{23}\) The Annual National Assessments are standardised assessments that have been conducted nationally by the DBE since 2012 and are conducted in a selection of both public and state-funded independent schools. The introduction of the ANAs coincided with the first year of the CAPS implementation. The purpose of the ANA is to test the skills and understanding of learners at various stages in their education, and in so doing identify shortcomings in order to improve the quality of teaching and learning (Motshekga 2014:6; Motshekga 2015a:3). The ANAs provide valuable feedback to schools, teachers and parents alike, and assists the DBE in developing intervention strategies to address the areas of weakness (Motshekga 2014:6).

\(^{24}\) The socio-economic link between education and poverty is proven by a comparison between the results of public schools and independent schools (which typically serve more affluent communities), which – unsurprisingly – show that learners at independent schools achieve higher scores (DBE 2014b:100).

\(^{25}\) The ANAs were offered in all official languages at the FP level, however they were only offered in English and Afrikaans for both the HL and FAL evaluation for the Intermediate Phase and Grade 9 evaluations. This means that the ANAs for the older learners did not consider any African languages (at HL or FAL level), which might have been the learners’ mother tongue, or HL subject.
language test scores does not reflect in similar tests conducted in North Africa or East Asia, where students excelled in taking tests in English regardless of not speaking the language at home (Howie & Plomp, cited by Fleish 2008:113). Hartshorne (cited by Fleisch 2008:116) explains an alternative theory: that the reason for this outcome in SA test scores is not the result of students receiving less mother tongue instruction, or that mother tongue instruction is limited to only three or four years, but that it comes down to the fact that inadequate attention is given to English language acquisition during the FP years.

Despite the allegedly satisfactory HL performance of FP learners reported by the ANA, Gustafsson et al. (2016:5) report that “approximately 58% of SA children do not learn to read for meaning in any language by the end of Grade 4”, and that even though the intention is that learners can read upon exiting the FP, this “is not supported by the evidence”. This discrepancy in results is immensely concerning. Gustafsson et al. (2016:15) maintain that poor performance is often compounded by the fact that learners need to switch to using an additional language, without first becoming literate in their HL (Spaull 2016:2).

Gustafsson et al. (2016:13) identify four ‘binding constraints’ that contribute to weak educational outcomes in SA; the most concerning of which is the dismal failure of children (especially those from poor households) to be able to read with comprehension – in both the HL and the FAL – upon exiting the FP (Gustafsson et al. 2016:13,56; Jackson et al. 2016:4). The causes that Gustafsson et al. (2016:6–9,13) identify are: weak institutional functionality; undue union influence; weak teacher content knowledge and pedagogical skill; and wasted learning time and insufficient opportunity to learn in the classroom. Gustafsson et al. (2016:6–9,44) also indicate that it is difficult to measure the extent to which each of these factors contribute to weak outcomes due to “high correlations with other input variables”. Gustafsson et al. (2016:13,23) believe that sustained improvement in the entire education system will only be possible if reading (fluently and comprehensively, in both the HL and the FAL) is prioritised in the FP, and that this in turn relies on systemically addressing the ‘binding constraints’ that they identify.

1.2.4.4 THE IMPACT OF POVERTY ON EDUCATION AND ACHIEVEMENT

Fleisch (2008:55) defines poverty as the “inability to acquire the essential material means to maintain life”, which generally translates to low income and few assets. In 2015 more than half of SA’s population (53.8%, or 27 million people) lived in poverty, of which 21.7% of the population (or 10.7 million people) lived in extreme poverty(Statistics SA (Stats SA), cited by Grant 2015; Stats SA, 26 A poverty line is used to determine the number of people in a country who are living in poverty. It is typically determined using a cost-of-basic-needs approach, which links welfare to the consumption of goods and services, which are typically separated into food and non-food components. The concept of a ‘poverty line’ has received criticism, as someone who earns just above the threshold is considered ‘not poor’ but still typically
Figures from 2013 indicate that of all children below the age of 18, 55% live in poverty\textsuperscript{27}, and 30% live in extreme poverty (Hall & Sambu 2015). Of these children, 61% are African, 28% are coloured, 6% are Indian and only 3% are white, which shows that poverty in SA is distributed unequally among race (Hall & Sambu 2015). Furthermore, 32% of SA children live in households where neither parent is employed\textsuperscript{28} – and high unemployment unsurprisingly leads to high poverty (Hall & Sambu 2014:95; Fleisch 2008:55,59).

Fleisch (2008:51,53) cites several SA studies that show a consistent, direct relationship between socio-economic background and academic performance – it is generally found that children from low-income families “perform poorly in tests of reading and mathematics” when compared to their peers from middle- and high-income families\textsuperscript{29}. Although “[p]overty in the abstract does not cause underachievement”, it does present several barriers that make it more difficult for poor learners to excel (Fleisch 2008:52). Some of the more apparent learning disablers that stem from poverty include insufficient and irregular income affecting school enrolment, attendance, and affording stationary and school uniforms (Fleisch 2008:31,67). Poverty also affects achievement because of what happens in the home environment – such as parental education, reading culture, the nature of language usage, symbolic practices, and access to reading materials (Fleisch 2008:60; Muller, Taylor & Vinjevold cited by Fleisch 2008:54). Children from poor households are also more likely to attend underprivileged schools, which tend to lack – or underutilise – textbooks and resources, and fail to provide effective and adequately trained teachers (Fleisch 2008:138).

Poverty is a major problem on its own, but it also tends to amplify other obstacles that can be difficult to overcome, irrespective of socio-economic status. Some of these factors that could present barriers to learning include: health and nutrition (especially with regard to malnutrition, infection, and disease, especially HIV/AIDS); physical disabilities and special needs (including impediments related to eyesight, hearing, or speech); literacy problems; access to support materials; government expenditure; prevalence of crime in school environments; language use in the curriculum; and problems in the classroom that stem from ineffective teaching (DOE 2009:1; Ramdass 2009:111–116; Fleisch 2008:32–50,121; McPherson & Swart cited by Fleisch 2008:40–41; DOE 2003:34–37).

Fleisch (2008:139) draws attention to hurdles that are presented and propagated by poverty, but he points out that the overarching problem is that “the extent to which each of these factors contributes struggles to make ends meet. A poverty line also does not identify how resources are divided up among family members or how money is spent (Hall & Sambu 2015).

\textsuperscript{27} This figure has dropped notably since 2003 when the figure was at 74% (Hall & Sambu 2015).
\textsuperscript{28} As of November 2016 SA’s unemployment rate is at 27.1% (Statistics SA 2016).
\textsuperscript{29} It must be noted that the reported poor reading skills upon exiting the FP are not limited to low-income, African language-learners, and that this extends to English and Afrikaans Home Language-learners, however in such cases poor achievement is also localised to rural areas or townships (Spaull 2016:3)
to school failure and in which combinations” remain unknown (Gustafsson et al. 2016:6–9,44; Hoadley 2016:35–36). It is this gap in the research that provides the biggest stumbling block to narrowing the achievement gap, which is only marginally narrower now than it was during apartheid (Fleisch 2008:139). It is, however, evident that any combination of these factors is likely to result in a low standard of education, to exacerbate poor performance, and to continue the cycle of poverty. The current state of education is cause for concern, and although all these factors pose their own challenges, this study focuses on the role of additional language acquisition in the FP, and how the SA context provides a unique framework within which to address the research problem.

1.2.4.5 THE ROLE OF LANGUAGE AND THE EFFECT OF POVERTY

The language of learning and teaching (LOLT) that is used in the classroom is crucial, as it forms the basis of how children learn and how teachers teach. The fact that the teaching of all subjects for the duration of the FP is in the HL is not problematic, however, the fact that the LOLT then switches to English (or, less commonly, Afrikaans) for the remainder of the schooling phases poses several challenges. This problem is exacerbated by the fact that inadequate attention is given to English language acquisition during the FP years, which means that learners are ill-equipped for being introduced to new subjects that are taught in English when they enter the IP (Hartshorne cited by Fleisch 2008:116).

In the FP, approximately 80% of all learners do receive instruction in their home language (with the top three preferred languages being isiZulu, English and isiXhosa) with 65% of learners being taught in an African language (DBE 2010:17). However, once learners advance to Grade 4, the overwhelming majority switches to English as the primary LOLT, even though less than 10% of South Africans speak English as a home language (Index Mundi 2014). The HL subject at FP level typically involves decoding letters, and using simple vocabulary and sentences in familiar narratives – children are still acquiring the ‘tools of learning’ (reading and writing) (Fleisch 2008:105–106). And yet, once learners reach Grade 4, they are required not only to start using the ‘tools of learning’ to learn an array of new subjects, but also to do so in a language in which they are not fully proficient (Fleisch 2008:105–106). The concept of additive bilingualism, which has been explained previously,

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30 This figure has increased from 55% in 1998 to 80% in 2007 (DBE 2010:17).
31 For the remainder of their schooling, approximately 80% of students receive tuition in English and approximately 13% in Afrikaans. The remaining 7% receive tuition in one of the nine official African languages, none of which are formally recognised as LOLTs (DBE 2010:16–17). Data further shows that from the Intermediate Phase onwards, only 27% of students’ LOLT overlaps with their home language (DBE 2010:19).
32 According to the latest SA survey (2011), 9.6% of the population speaks English as their home language, and 13.5% speaks Afrikaans as their home language (the only other option presented for language of instruction from Grade 4 onwards). Of the remaining population almost 75% speaks one of the nine official African languages as a home language (with isiZulu and isiXhosa both being more prevalent than either English or Afrikaans) (Index Mundi 2014).
fortunately allows for skills to be transferred from the HL to the FAL\textsuperscript{33}, since skills such as handwriting and phonics need not be releamt for the additional language (DBE 2011a:8). In order to accommodate the still ‘foreign’ additional language at this level, the FAL subject requires even simpler activities than the HL subject and the application of this new language to subjects other than literacy remains very limited.

The language policy in the FP has been considered the root of poor learner performance throughout all school levels (Dale-Jones 2013; Foley 2010:2). Although the inclusive and multilingual policy bestows recognition and importance on all official languages, reverting to English as the LOLT after three years of schooling debilitates both learning and teaching (Dampier, cited by Dale-Jones 2013). Dampier (cited by Dale-Jones 2013) warns that whereas a home language is a tool of “cultural preservation and articulation”, the additional language is reduced merely to a tool of necessity to facilitate communication, and is never regarded as ‘essential’ to second-language speakers\textsuperscript{34}. As a result of this, English assumes an “unstable and uncertain” role in the FP classroom (Dale-Jones 2013). Fleisch (2008:98) reiterates that academic underachievement can partly be attributed to the premature departure from mother tongue instruction and expecting learners to understand abstract concepts in academic contexts in an additional language. However, there lies a problem with this conclusion. If the majority of the country speaks an African language it is a logical conclusion that the majority of the SA population is in fact African (79.2%) (Index Mundi 2014). By continuation, of the 79.2% of South Africans who are black, 40.3% are living in poverty, and furthermore African households make up the majority of poor households, accounting for 93.2% of all poor households (Stats SA 2014b:42). Additionally, historically disadvantaged schools (where the HL in the FP is more likely to be an African language) are already subject to predispositions – in terms of infrastructure and availability of resources – that burden them, irrespective of language (Fleisch 2008:102). Therefore, the problem presented by this statistical evidence regarding mother tongue instruction is that the students who have African home languages, and are more likely to have difficulty adjusting to English as the language of instruction, are typically also subject to socio-economic variables such as poverty, poor health and under-resourced schools, all of which can further contribute to underachievement (Fleisch 2008:104; Gustafsson \textit{et al.} 2016:15).

The existing research fails to “disaggregate language determinants from the host of other associated factors such as poverty and [adequate schooling]”, which makes it difficult to establish the effect that language in isolation has on achievement (Hoadley 2016:35–36; Fleisch 2008:118). The fact remains that the number of FP learners learning in their home language has increased from 55% in

\textsuperscript{33}The FAL is introduced in Grade 1, and should reflect the LOLT used from Grade 4 if the Intermediate Phase and FP LOLT differ.

\textsuperscript{34}The same holds true for English home language learners learning any African languages as their FAL.
1998 to 80% in 2007 (DBE 2010:21), and even though this figure has increased dramatically, there is no corresponding improvement in learner performance over the same period. This leads one to question whether the LOLT does play a significant role in achievement, or if this performance is being affected by factors other than the language of instruction, or if being taught in one’s home language is simply not enough (DBE 2010:21). Since FP achievement tends to be of an acceptable level (averages of over 50% across all grades), and the sharp decline is seen in the phases that instruct predominantly in English, it is a safe assumption that the problem may well lie in the lack of comprehension of subject matter due to a limited proficiency in English. And therefore, as Hartshorne (cited by Fleisch 2008:116) rationalises, the problem lies with inadequate attention being given to English during the FP.

1.2.5 SIGNIFICANCE OF RESEARCH

Education helps individuals realise their full potential, contributes to an inclusive society, and provides tools to allow for problem solving (Motshekga & Surty 2016:6). Furthermore, education empowers people to lift themselves out of poverty (DBE 2016a:22). The SA government allocates a significant portion of its budget to education and most children are enrolled at school, but this does not seem to make a difference to the consistently poor performance of learners or to the remediation of poverty and inequality faced in the country (Gustafsson et al. 2016:14). This means that despite the changes made to the education policy, and the money spent on upgrading infrastructure and developing support materials, that – to some extent – the cause of the consistent underachievement lies in the classroom. More specifically, this lies with the fact that most SA learners are required to switch from their mother tongue to English as the LOLT in Grade 4, even though very few children are familiar with this language by the time they complete their FP (DBE 2011a:8; DBE 2010:20). When entering the IP, children are expected to switch from ‘learning to read’ to ‘reading to learn’ in a language they do not fully comprehend, and with minimal guidance through this expected transition (Gustafsson et al. 2016:5; Spaull 2016:1; Fleisch 2008:106). This is exacerbated by the fact that children cannot even ‘read for meaning’ in their HL upon exiting the FP (Spaull 2016:1–2). The crippling effects of poor literacy and, more importantly, poor proficiency in English, and the resultant cycles of low-quality education, poor achievement, and poverty, are where the significance of the research problem lies.

This section elaborates on the significance of this research study by detailing how education can help break the cycle of poverty, and by emphasising the importance of learning an additional language in the SA context. The section concludes by providing a final motivation for the necessity

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35 For the financial year 2015/16 SA spent approximately 15% of its budget (R203 468 billion) on basic education – this is the single function that the government spends the most on (Davis 2015). Between 2015 and end-2017 roughly R640 billion will go towards basic education (Davis 2015).
of this research and design intervention, and the contribution that it can make to the field, before proceeding to delimiting the problem statement and subsequent research questions.

### 1.2.5.1 Breaking the Cycle of Poverty

Children need to be educated, not only to promote skills, but also to help combat intergenerational poverty. Although a decent education improves the life of an individual, it also has a “cumulative positive effect for each subsequent generation”, as educated people are more likely to seek the same for their own children\(^\text{36}\) (Hall 2014:109). This is especially true in developing nations where the majority of the population lives in perpetual poverty, and the best way to enable people to elevate themselves out of this cycle is through a good education\(^\text{37}\) (DBE 2014a:14; Ramdass 2009:111,127; Blackman & Litchfield 2001:2). The National Development Plan (NDP) explains the necessity of quality education in the cycle of development, and its economic importance in contributing to the alleviation of poverty and inequality as follows: “[i]mproved education ... will lead to higher employment and earnings, while more rapid economic growth will broaden opportunities for all and generate the resources required to [further] improve education” (National Planning Commission 2011a:25–26).

The 2014 *Poverty Trends Report* shows a definite link between higher levels of education and decreased levels of poverty stating that there are “stark differences when one examines poverty status according to the education status of individuals” (Stats SA 2014a). This leads one to deduce that if children from poor households are given the opportunity to access better education and improve their achievement, the cycle of poverty could potentially be broken (Farber 2014). And subsequently, individuals with a higher level of education could also reduce their chances of unemployment (Stats SA 2014a). However, Stats SA (2014a) warns that “[e]ducation alone cannot eradicate poverty; rather, education coupled with greater job opportunities in the economy will be the roadmap out of poverty”. Since “education is perceived as the single most significant way out [of being poor], even if little real opportunity is available”, many disadvantaged parents prioritise education and make significant sacrifices in an attempt to provide a quality education for their children in order to escape social stigma\(^\text{38}\) and break the cycle of poverty (Fleisch 2008:59,68). It is thus the SA government’s responsibility to ensure that “educational relevance and quality coexist”

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\(^{36}\) Children’s educational attainment generally reflects that of their parents’ – this is not linked to parental expectation, but rather to the culture that has been adopted by the parents due to the limit of their education (Case & Deaton cited by Fleisch 2008:60; Anderson & Beutel cited by Fleisch 2008:61).

\(^{37}\) This touches on human capital theory which states that “people will seek education opportunities to increase their economic options by improving their productivity in society and that will eventually enhance their quality of life” (Griffith 2012:90).

\(^{38}\) Being poor, and being regarded as such, often leads to social isolation and disempowerment (Fleisch 2008:59).
and that those who have been historically disadvantaged and excluded are given equal educational opportunities (Motshekga 2015d).

### 1.2.5.2 The Importance of Learning an Additional Language

Mastering basic educational skills at an early age provides children with the building blocks to advancing their school careers and their futures (Gustafsson et al. 2016:10). According to Project Literacy ([sa]), educational deprivation has resulted in 4.7 million SA adults being completely illiterate. An additional 4.9 million adults abandoned their education before completing primary school and are classified as functionally illiterate. Basic literacy and numeracy empower individuals and reduce their dependency on others when it comes to job applications, filling out forms, applying for bank loans, understanding instructions, and voting (Project Literacy [sa]). Even though illiteracy in a person’s HL is problematic, this is exacerbated when a person is illiterate in the country’s dominant language of communication, as this limits even the most basic interaction with speakers of other languages.

Bilingualism has many benefits, but for SA non-English speakers it is essential to speak English, as it is the language of business, politics, government administration, higher education, and, essentially, the national *lingua franca* (Index Mundi 2014; Essien cited by Dale-Jones 2013; Foley 2010:2; Heinemann & Horne 2009:2; August & Hakuta 1997:14). Until 2012 English was not taught comprehensively, however, between 2012 and 2014 the DBE implemented the compulsory teaching of an additional language for the FP. By receiving an adequate foundation in the LOLT that is used after the FP, the country’s educational inequality may be alleviated. If learners have a solid foundation in English upon exiting the FP, they should be able to have greater cognitive access to the subject matter that is taught throughout the remainder of their schooling. This should lead to better achievement in all subjects, which will hopefully lead to the narrowing of the achievement gap and the poverty gap, and eventually lead to greater societal equality. It is, however, imperative that learners master the basic skills and concepts that are taught during the FP, since failure to do so puts them at a perpetual disadvantage throughout their schooling, as each grade and phase builds on the knowledge acquired in the previous years (Gustafsson et al. 2016:10; Spaull 2016:1). The DBE claims that introducing English at FAL level from Grade 1, advocating and implementing reading campaigns, and providing English reading resources to learners, have aided with this transition of the LOLT and should gradually improve learner performance (DBE 2015a:62; DBE 2014b:18–21).

### 1.2.5.3 Motivation for Research and Design Intervention

Fleisch (2008:v,1–30) believes that SA primary education is the epitome of unequal learning, and the two ‘systems’ he identifies are differentiated not only by the level of skills and knowledge they impart on children and their access to resources, but also by the backgrounds of the children whom they serve. Ramdass (2009:118) elaborates on this dichotomy by stating that SA is experiencing a
“racial tension that divides the nation and prevents SA … from becoming a global first-world country”. Ramdass (2009:118) believes that the reason for this lies in the government’s inability to provide fair and good-quality education to all. The DBE (2013:5) also recognises this social divide that exists in SA, and believes that it is further amplified by the “communication gaps” that exist between “speakers of the different official languages”.

Fleisch (2008:30) identifies that “South Africa’s primary education achievement gap, with its distinct bimodal distribution, begins in the FP, at the very earliest days of formal schooling, and continues unbroken to the end of primary education and beyond”. Even though ANA results show that FP learners achieve at an acceptable level in their HL and Mathematics, two of the main contributors to the achievement gap is the inadequate teaching of the LOLT that is used after the FP, and the subsequent change of the LOLT that most learners face upon entering the IP. The provision of quality education from the IP onwards is hampered by the fact that once learners are meant to start using the foundations of learning to learn new subject knowledge, they are incapable of doing so successfully, due to their inability to comprehend the language of instruction. This leads to limited engagement with the curriculum, and as a result learners are ‘silently excluded’ (Jackson et al. 2016:4; Spaull 2016:5). The intention of this study is to address this problem from an industrial design perspective resulting in a design intervention in the form of a product that acts as an assistive device to aid the learning and teaching of an additional language in the FP.

SA’s socio-economic inequalities can be seen across all generations, but it is believed that earlier educational interventions can have a significant impact on interrupting the cycle of poverty and inequality (Hall 2014:106). Some of these inequalities can be addressed through “pre-school exposure to developmentally appropriate activities and programmes that stimulate cognitive development”, which would allow these differences to be adjusted at an early age (Hall 2014:106). The DBE’s aforementioned interventions that focus on strengthening the teaching of English across the curriculum starting in Grade 1 are testament to strategies that aim to address educational challenges at an early age. This is where the proposed design intervention fits in. The product, however, is not limited to the teaching and learning of English, but focuses on broad-based additional language acquisition, as learners who have a non-African language as their HL are also obliged to have a better grasp of their elective additional African language, as this is vital to encouraging multicultural cooperation and communication.

This study’s resultant design intervention is intended to benefit learners from all demographic backgrounds, however it is because of the inequality in the education sector that the plight of children who are from underprivileged backgrounds is of particular pertinence to this study, since the majority of SA children falls into this category (Gustafsson et al. 2016:13; Farber 2014; Poverties 2013; Crawford 2012). These children are also at a greater disadvantage due to the historical impact of
segregation and the resultant poverty. African language-speakers have been affected by this more so than their English and Afrikaans speaking counterparts, and African language-speakers thus have a greater necessity for receiving a more thorough introduction to English as a First Additional Language in the FP. This is what is understood by the SA context. The issues and subsequent contextualisation that have been identified throughout this section deem valid the necessity of an intervention, and through an industrial design approach, this study hopes to make a constructive contribution to the field.

1.3 **PROBLEM STATEMENT**

This study investigates the problem of inadequate First Additional Language (FAL) tutelage – with a focus on English – within the FP, from an industrial design perspective. Although the DBE is attempting to alleviate this problem, there is no ‘product’ available to support the teaching and learning of an additional language, that is conducive to the SA context. This study applies a user-centred design approach (that looks at the roles of both teachers and learners as the users) to the development of an educational toy that supports the teaching and learning of an additional language at the FP level. This design intervention is primarily intended to support learner proficiency in the most prominent FAL (English) and thereby ameliorate the transition of the language of learning and teaching (LOLT) faced in the IP.

1.4 **RESEARCH QUESTION**

How can the design of an educational toy support the teaching and learning of an additional language in the Foundation Phase?

1.5 **PROJECT DESCRIPTION, SCOPE AND OBJECTIVES**

1.5.1 **PROJECT DESCRIPTION**

This study conducts primary and secondary research that results in the development of a product that has the potential to ameliorate the transition of the LOLT faced in the IP. More specifically, this research leads to the design of an educational toy that supports the learning and teaching of an additional language in the FP, and considers both teachers and learners as users. The product’s success can be measured by whether it is effectively used and understood by teachers and learners alike.

The kind of toy that is developed is determined through the primary and secondary research. Although the literature review looks at existing precedents, primary research feedback from key
informants has a more substantial impact on the product development. The research locations include schools and learning centres in the Johannesburg region that use English as their primary language of instruction in the FP. The backgrounds and demographics of the learners and teachers who participate in the study are varied, and are determined by the communities that surround the chosen research locations. Although this study proposes and tests the design solution, the intention is not to implement the solution.

1.5.2 PROJECT SCOPE AND LIMITATIONS

The preceding description provided a broad overview of the project intention, and to aid with clarifying this further, the research scope and study limitations are elaborated upon. The scope of the project is delineated and motivated in terms of: the industrial design perspective, the limitations of use and users, and the scope of the design intervention within the framework of the SA context.

1.5.2.1 THE INDUSTRIAL DESIGN APPROACH

As mentioned in the problem statement, this study is undertaken from an industrial design perspective. The World Design Organisation (WDO) ([sa]), formerly known as the International Council of Societies of Industrial Design (ICSID), defines industrial design as follows:

“... a strategic problem-solving process that drives innovation, builds business success, and leads to a better quality of life through innovative products, systems, services, and experiences. Industrial Design bridges the gap between what is and what’s possible. It is a trans-disciplinary profession that harnesses creativity to resolve problems and co-create solutions with the intent of making a product, system, service, experience or a business, better. At its heart, Industrial Design provides a more optimistic way of looking at the future by reframing problems as opportunities. It links innovation, technology, research, business, and customers to provide new value and competitive advantage across economic, social, and environmental spheres.”

This definition informs how the study addresses the research questions within the capacity of industrial design. Furthermore, approaching any problem from an industrial design perspective places an emphasis on both users and the environment. According to the WDO ([sa]) industrial designers acquire an “understanding of user needs through empathy and apply a pragmatic, user-centric problem-solving process to design products, systems, services, and experiences”. An industrial design approach generally spans and connects a number of disciplines – as with this study, which links product design, education, children and additional language acquisition, in order to address problems evidenced in SA as a result of government incompetence. Even though the study investigates these topics in order to develop a suitable framework within which to design, the focus of the study is still the design of a tangible end product. The design development is also obliged to consider the environmental impact of the product’s manufacture and use, but this is measured against the product’s affordability and accessibility. The industrial design approach thus delivers a holistic solution to a problem to contribute “towards co-creating a better quality of life” (WDO [sa]).
1.5.2.2 LIMITATIONS OF USE AND USERS

As previously mentioned, the industrial design approach has an implicit responsibility towards considering the user. It is thus necessary to delimit ‘the users’ within the framework of the project description. The primary users of the educational toy are the learners who interact with it, however the assistive role of the teachers (and, to a lesser extent, the parents) is pivotal to the learning process and thus the needs of these facilitators are also considered in the design of the product. Although this educational toy can operate within the home environment, its primary intention is use within the classroom. As such, when designing the product, it is assumed that the adult who facilitates the learning process does have some knowledge of additional language tutelage.

The primary users of the product also require further delineating. The term ‘children’ is broad, and generally spans all individuals from birth to puberty, although in legal terms a ‘child’ is anyone under the age of majority (which is 18 in SA). FP learners fall into the ‘younger school age children’ category (6–12 years), and in terms of stages of childhood, FP learners fall into the tail-end of ‘early childhood’ (2–6 years, Grade R) and the beginning of ‘middle childhood’ (7–14 years, grades 1–3) (Beran & Brown 2008:22,26). For the remainder of this study, the term ‘children’ refers to individuals who fall in the FP age classification, and the literature concentrates on children aged 6 to 9.

Furthermore, in terms of the FP, this study focuses on grades 1–3, and excludes Grade R. Grade R differs significantly from the other FP grades, as it has a more relaxed, play-based approach to teaching and learning, and it does not have the typical formal structure that is found in the rest of the schooling phases (DBE 2011b:20). In Grade R, the teacher acts more as a proactive mediator rather than a facilitator of learning, and assessment activities are informal and nonessential (DBE 2011b:20,21). Grade R focuses on informal and spontaneous learning, and is designed to allow for optimal time for free play (DBE 2011b:20). During Grade R children “make sense of their world and acquire the knowledge, skills, values and attitudes” in a more rudimentary way than older learners, and this is not conducive to traditional schooling (DBE 2011b:20). Grade R learners also tend to be removed from the formal schooling environment, in favour of being included with the younger pre-primary learners. This, coupled with the facts that many of the principles that underpin early learning are still reinforced in Grade R, and that an FAL is not taught at this level of schooling, shows that Grade R is too far removed from the structured common nature of grades 1–3 to be included in the scope of the study (DBE 2011b:21).

1.5.2.3 THE IMPACT OF THE SOUTH AFRICAN CONTEXT

As mentioned in the contextualisation of the study, recognising poverty – and the learning barriers that stem from it – is fundamental to understanding the SA educational landscape, and as such needs to be taken into consideration when designing the proposed product, as this ensures that the toy is relevant to as many children as possible. This being said, the resultant design intervention is
intended to be beneficial to learners from all demographic backgrounds, it is simply because of the inequality in the education sector that the plight of children who are affected by poverty (often as a result of historical disadvantage) is of particular pertinence to this study, since the majority of SA children falls into this category (Gustafsson et al. 2016:15). Furthermore, since most children living in poverty are African-language speakers (63%), the language factor is also of heightened concern, as these children have a greater necessity for receiving a more thorough introduction to English as an FAL in the FP, as they are unlikely to receive the necessary exposure in their home environment.

This being said, the study does not argue for or against instruction in any particular language, as this is not the researcher’s field of expertise. The fact of the matter is that most FP learners are required to learn English at FP level, but that it is not being taught comprehensively at this level of schooling, which affects achievement for the remainder of learners’ education. However, the product is also not limited to the teaching and learning of English, but instead focuses on broad-based additional language acquisition, as learners who have a non-African language as their home language are also obliged to have a better grasp on their elective additional African language, as this is vital to encouraging multicultural cooperation and communication.

Instead of designing a product that specifically supports the acquisition of English, the design process recognises this necessity, and subsequently the awareness of children from underprivileged backgrounds is evident in design considerations that implicate the affordability, accessibility, usability, longevity and contextual relevance of the product. The product is designed to be used in disadvantaged contexts, but in such a way that it does not exclude those users who are not affected by poverty or more challenging learning environments. This aligns with universal design theories that are elaborated on in the literature review, and this is where the industrial design expertise of the researcher plays a critical role.

1.5.3 AIMS AND OBJECTIVES OF THE STUDY

The principal intention of this study is to explore a design solution (in the form of a product) that supports additional language learning and teaching in the FP in the SA context. In order to achieve

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39 In the context of this study, the term ‘underprivileged’ refers to children who are from disadvantaged backgrounds – these children are typically from low-income households where there are deprivations in quality health care, education, social infrastructure and income-earning opportunities (National Planning Commission 2011b). This, in turn, impacts on a child’s ability to grow, develop, and reach their full potential (Poverties 2013). Underprivileged communities can alternatively be referred to as ‘under-consumers’ and can be recognised by the unequal distribution and consumption of resources and the unjust deprivation of the standard of privileges to which society is entitled (Fuad-Luke 2009:125; Barnhart & Metcalf 1997). Under-consumers typically live in poverty and need to increase their consumption in order to improve their quality of life (Fuad-Luke 2009:78). ‘Underprivileged’ children typically attend schools that are under resourced, and are categorised as former black or historically disadvantaged schools, due to their classification during apartheid.
this, the aims of the study are formulated around, firstly, research, and secondly, design. More specifically:

– The thorough research of available literature to determine the framework of the study, identify the research gap, and develop an understanding of the design considerations.
– Triangulated primary research through interviews with participants and tactical observations, to gain insight into the research gap and guide the design process. Key areas of investigation determine what the specific FAL-related learning difficulties are, and how the design of an assistive learning device can address the challenges faced by teachers and learners alike.
– The user-centred design and development of an educational toy that supports additional language learning (and teaching) for FP learners, based on the findings from both primary and secondary research.

The specific outputs and deliverables that this study yielded can be found in Appendix B.

1.6 THEORETICAL POSITION

This study is embedded within the theory of design, as described by Pentti Routio (2007). According to Routio (2007 ‘Theory of design’), theory of design can be influenced by a number of different discourses – depending on the intention of the research project – and any product or product-based research intervention, can be approached from various points of view. These are predominantly based on product-specific perspectives (such as usability, ergonomics, safety, semantics and semiotics, ecology, or aesthetics), but can also encompass other fields of study (such as education) that may influence the design and development of the product, or that may help contextualise the design requirements.

Elaboration on the theory of design (as it relates to industrial design) shows that there are two approaches to a product-based research study, both of which are used in this study (Routio 2007 ‘Theory of furniture’). The first is a descriptive approach – both intensive and extensive – that encompasses the objective research and presentation of facts and knowledge that are considered invariable, without suggesting changes thereto. The second is a – primarily intensive – normative approach, which studies the “needs and goals of people [and] how to fulfil them or how to remove practical problems by modifying [or improving] the object of study” (Routio 2007 ‘Theory of furniture’). In the case of this study, the normative approach is idiographic, meaning that it relates to “assisting the creation of a single new product”, as opposed to informing “universally applicable theories of

40 Refers to a focus on improving “the present state of things” by developing a new product, particularly by looking at exemplars of earlier designs (Routio 2007 ‘Theory of Furniture’).
design" (Routio 2007 ‘How to create theory of design’). The descriptive approach of this study allows for the investigation of “how things are”, whereas the normative approach allows for the inquiry as to “how things should be” (Routio 2007 ‘How to create theory of design’). Furthermore, as this study is ideographic the descriptive research allows for the evaluation of the current situation, and to investigate how the product intervention can ameliorate this (Routio 2007 ‘How to create theory of design’).

The descriptive research that informs the framework of understanding and evaluation within which this study falls, draws from different fields of study. By drawing on theories and research relating to both education and design, the researcher is able to understand that which exists, and the present state thereof. This stage of the research demands an interdisciplinary approach, and investigates the fields of FP education, understanding children and how they learn, and designing for children, in order to inform the research problem (see Figure 3). These topics are investigated in Chapter 2. This descriptive research is then used as a basis for the intensive normative approach to evaluate the research problem, and subsequently inform the design of the proposed intervention. The analysis of exemplar products that aid in language development, as well as the undertaking of field research, contribute to the normative approach by supporting the understanding of how to improve the existing situation through the design of a product-based intervention. In the case of this study, the intention is to combine research and design, with the purpose of posing a solution (product) “on the basis of the information that has been collected” regarding the identified product (Routio 2007: ‘Developing an Industrial Product: Synthesis in Product Development’).

Bearing in mind the theory of design, the philosophical stance that informs the methodology and provides theoretical context for this research study is based on the interpretive paradigm, which suggests that individuals construct their own reality, and that as a result there are multiple, subjective interpretations of a scenario (Munro 2014:52; Macleod 2009). Heeding the interpretivist paradigm,
this research study lends itself to an action research design approach as conceptual framework. Action research design is largely dependent on reflection and iterative cycles, and as such, has great appeal to researchers in the fields of design who have an interest in problem-solving, tangible outcomes, as opposed to proving scientific hypotheses. These concepts are further elaborated upon in Chapter 3.

1.7 OVERVIEW

Chapter 2 provides a review of the relevant literature that informs this study. The bulk of this chapter contributes to the aforementioned descriptive research that aids in identifying the facts and knowledge that determine a framework for understanding, and eventually evaluating, the design requirements of the end product. The literature consults a variety of sources, including books, journal articles, government-provided documentation, national and international reports, and policy documents. Throughout this chapter, the importance of the research problem is reiterated and reinforced, and the chapter describes and evaluates existing research and other sources as they relate to the research problem. This literature is used as the foundation that informs the design requirements, the questions posed during field work, and the analysis of the findings. The literature also aids in locating this study within the context of existing literature. The content that is covered in this chapter is divided into the following sections: FP education, understanding children and how they learn, design for children, and language development precedents. The literature review concludes by identifying any gaps that exist in the literature, which links to the significance and necessity of the research study.

The literature review leads on to Chapter 3, which discusses the research methodology. This chapter aids in delimiting both the theoretical and conceptual frameworks of this study, and guides the direction of the field research. This chapter also serves to describe the methods that were used to collect, generate and analyse primary data, and the reasons why these were chosen, in light of the research problem. The content that is covered in this chapter can be divided into two sections. The first identifies and discusses universal aspects to research methodology, namely the research paradigm, the research design and methodology, and the design process, as they pertain to the research study. The second is more specific to this study and starts by describing the location of the study, whereafter the data collection methods, the sample, and the data analysis methods are described. This is followed by a detailed report of the field research that was conducted through the various phases of the study. The chapter concludes with a section regarding the ethics of research, and emphasises aspects that are particularly pertinent to this study.

The design process that was followed in the study, as well as the research findings that influenced the design decisions, are captured in detail in Chapter 4. Using the design process described in
Chapter 3 as an outline, Chapter 4 discusses each phase of the research study (Phases 1–10); reports, analyses and reflects on both primary and secondary findings; and describes the resultant design conceptualisation, development and refinement. The purpose of this chapter is to “interpret and describe the significance of [the researcher’s] findings in light of what was already known about the research problem being investigated” (Labaree 2015). Furthermore, the research findings lead to new insights into the research problem and the researcher reflects on these in order to explore solutions to the research problem that are informed by the “evidence-based interpretation of findings” (Labaree 2015).

Chapter 5 concludes the dissertation by summarising the critical findings of the study, revisiting the research question, and making recommendations for further research. The concluding chapter illustrates the researcher’s understanding, interpretation, and addressing of the research problem and the research gap. The resultant design intervention is placed in the context of past research, as well as the study’s findings, in order to reiterate the significance of this study. The dissertation closes with suggestions for additional approaches to addressing the research problem, from both an academic and a design perspective.

1.8 CONCLUSION

Throughout this introductory chapter, it is evident that a need exists for an intervention in the broader context of education in SA. Regardless of curriculum revisions and consistently high government expenditure, the inherited inequalities in the education system continue to reflect existing socio-economic inequalities, thereby “limiting the future work opportunities and life chances of children who are born into poor households” (Hall 2014:109). Underachievement at school is exacerbated by the slow uptake of literacy and numeracy skills in the FP years, and this debilitates learners throughout their education (Fleisch 2008:76). Based on the contextualisation section, the significance to this study is made apparent, as the need for additional support for the acquisition of an FAL (with a focus on English) is a particularly relevant and pressing problem in SA.

The intention of this study is to explore the possibility of an educational toy supporting the learning and teaching of an additional language through a user-centred, industrial design perspective. It is particularly relevant to address this problem during a child’s FP, as this is where the key determinants of a child’s success are formed. Bearing in mind the scope and limitations that have been identified, this study attempts to answer the research questions using the theory of design as the theoretical framework and the guide to approaching further research. It is hoped that this design intervention will contribute to greater cumulative comprehension of subjects taught in predominantly English starting in the IP, will improve learner performance, and will eventually contribute to the narrowing of the achievement gap.
CHAPTER 2 – LITERATURE REVIEW

2.1 INTRODUCTION TO LITERATURE

Due to the scope of the research problem, it is evident that this study encompasses several fields of study and schools of thought. The literature review acts as the secondary research and the descriptive phase – both extensive and intensive\(^1\) – of the study, that informs the design and development of a product that addresses the research problem. The topics that are reviewed also aid in delimiting the research questions, as they are addressed within the theoretical position that frames this study. The contextualisation that informs the significance of this study needs to be kept in mind throughout the remainder of the reported research, especially with regard to the delimitation of the SA context within the parameters of the research problem. The literature is divided into three central topics: FP education, children and learning, and design for children. This is supplemented with a section that discusses language development precedents, and the chapter concludes with the identification of the research gap.

The section regarding FP education (2.2) starts by describing the typical FP learner, and the FP curriculum. The section continues with an investigation of the teaching guidelines that are provided by the SA DBE, and looks at problems that arise from teachers and teaching practices within the SA context. Hereafter, the section explores Learning and Teaching Support Materials (LTSMs), and concludes by looking at learning difficulties faced by FP learners. The exploration of FP education aids in identifying the academic factors of the age group that this study is targeting, and is critical to understanding how the proposed design intervention needs to support or strengthen the syllabus as a LTSM, and how it can aid in overcoming any shortcomings that might be present in the classroom. It must be noted that this section relies on the aforementioned contextualisation (1.2) to provide a framework for the understanding of education in South Africa (in terms of the history, curriculum reform, the current state of education in the country, and the necessity and guiding principles of FAL instruction).

The second field of discussion is understanding children and how they learn (2.3). This section discusses the various developmental stages that children go through, provides an overview of learning in general, investigates the learning of an additional language in particular, and examines how children can be encouraged to learn. The learning aspect is elaborated upon, by exploring the most important aspects to ensure successful learning in children, and by elaborating on the importance of play in a child’s development, and the crucial role that this has in the learning process.

\[^{1}\text{Where ‘extensive’ refers to the research of facts and reports on knowledge which is accepted as true, and ‘intensive’ refers to specific case studies or exemplars (Routio 2007 ‘Theory of furniture’).}\]
This section provides an overview of relevant literature that allows for the design of a product that contributes to children’s growth, that appeals to children, and that is beneficial to their learning process. Some topics mentioned in Section 2.2 may seem to overlap with those in Section 2.3, however this is intentional. The differentiation between the two is that the former refers nearly exclusively to information garnered from government-issued documentation, or literature that refers exclusively to South Africa, whereas the latter addresses a broader understanding of children and learning, and compensates for any shortcomings in the literature provided by the DBE.

The third topic of study is design for children (2.4). This section looks at the physical constraints of product design, the adaptation of traditional product design aspects in order to ensure suitability for children, and the specifications of toy design. Age-specific preferences and play behaviour are investigated, as well as considerations for the design of educational toys. Throughout this section there is an emphasis on child-specific design requirements and the importance of product safety. An understanding of design that focuses on children allows for appropriate guidance to design a product that enhances a child’s development, and that appeals to the FP age-group without putting them at risk.

The fourth section of the literature review looks at precedent products that focus on language development, and their varying levels of success (2.5). To provide a comprehensive overview, this section first looks at both high-tech and low-tech precedents that specifically address the development of languages, and the possibility of using conventional toys as language development support resources is also investigated. The precedent study is concluded with the identification of government interventions that aim to improve literacy and language development. This study of precedent products covers examples that are used in both school and home environments, as well as examples that are available internationally, and precedents that have been developed locally.

Each of the aforementioned sections culminates by ascertaining the relevant research limitations. These sub-sections identify areas of the literature that require further study, present conflicting information, or provide insufficient evidence, but that fall outside the scope of this study. As such, the research limitations require that generalisations or assumptions be made, however the transference of research needs to be done with caution. Even though the research limitations are not addressed within the capacity of this study, they need to be acknowledged nonetheless. The literature review as a whole concludes by identifying the research gap, and drawing closing remarks (2.6). The secondary research that has been included in this literature review aids in building a framework against which the success of the design intervention can be evaluated. The final design intervention is intended to aid the learning – and teaching – of an additional language through creative play. By looking at the aforementioned fields of study, the researcher can develop an understanding of what a successful educational resource needs to encompass, and this informs and
clarifies the design direction. Through examination of the three core topics, and by looking at
exemplar products, the researcher is able to design a product that enhances a child’s development,
complements the curriculum, and aids in facilitating the learning process.

2.2 FOUNDATION PHASE EDUCATION

The first field of discussion for this study is FP education. The exploration of FP education aids in
identifying the needs, foci and challenges of the age group that this study is targeting. In order to
design a product for the educational environment it is necessary to understand how the product
needs to support or strengthen the syllabus, and how it can aid in overcoming any shortcomings that
might be present in the classroom, or even in the curriculum. The contextualisation section serves
as a framework within which SA FP education can be viewed. The following section is informed by
an understanding of the country’s political past and how this has affected education in the country,
as well as the current state of education in South Africa. The following section also considers the
overwhelming underachievement in schools and how this is affected by poverty, the impact that
curriculum reform has had on learner achievement, and the major challenge posed to students (and
teachers) by the transition of the language of learning and teaching (LOLT) (discussed in
Section 1.2). This section aims to delimit the FP, teaching in South Africa, and the language subjects
in order to develop an understanding of what is meant to be achieved in the FP, which – in turn –
helps locate the design intervention within this domain.

The following section has been divided into five topics that relate to FP education in South Africa.
This section commences with a brief overview of the typical FP learner (2.2.1), and continues with
an outline of the FP curriculum (2.2.2), placing particular emphasis on language and literacy
development in both the Home Language (HL) and the First Additional Language (FAL). A broad
understanding of the curriculum, the language subjects in particular, and their impact on a learner’s
development, helps build a framework against which the success of the final design intervention can
be evaluated. This also aids with identifying opportunities for optimising learners’ exposure to the
additional language within the current curriculum. Section 2.2.3 explores the teaching guidelines that
are provided by the SA DBE, and draws attention to possible opportunities where the proposed
design intervention can facilitate the teaching and learning process, by detecting shortcomings in
the classroom. Hereafter, Section 2.2.4 looks at the role of Learning and Teaching Support Materials
(LTSMs) to facilitate learning, and elaborates on recommendations for support materials as well as
the risks that accompany these. The final topic (2.2.5) provides an overview of learning barriers that
are typically faced by FP learners, which also provides a more detailed context for which to design.
Hereafter the section concludes by identifying the research limitations (2.2.6). This section as a
whole aids in establishing an understanding of the gap that the proposed intervention is meant to fill,
and furthers clarifies the SA context, and how the proposed intervention needs to accommodate for this.

This section relies predominantly on government documentation by the SA DBE\(^2\) to aid in delimiting the bulk of factual material required for the writing of this section. However, where necessary, this section also draws on Brahm Fleisch’s aforementioned book, *Primary Education in Crisis* (2008), Ursula Hoadley’s *Review of the Research Literature on Teaching and Learning in the Foundation Phase in South Africa* (2016) and the Research on Socio-economic Policy Institute’s *Identifying Binding Constraints in Education* (Gustafsson, Kotzé, Spaull, Van der Berg & Wills 2016). It must be noted that the literature focuses specifically on children aged 6–9, attending grades 1–3\(^3\), and does not include research regarding the other phases of education, as these do not fall within the scope of this study.

2.2.1 THE FOUNDATION PHASE LEARNER

Between the ages of 6–9, children develop in spurts rather than in a fixed manner, and these developments (either emotional, intellectual or physical) are unsynchronised and differ from child to child, which means that teachers need to accommodate for individual growth needs (DOE 2003:19). When children arrive at school at the beginning of Grade 1, they are typically expected to understand and speak the language used in their home environments, and they have a rudimentary understanding of mathematical concepts (such as sharing, and basic shapes) (DOE 2003:19). Although children of this age tend to display an eagerness to learn, they all have different experiences, interests, strengths and barriers that need to be addressed (some might need to catch up or do extension activities), and each one has an innate need to be recognised and accepted (DBE 2011c:67).

Children entering the FP tend to “know much less about the everyday world than adults realise, but they have more intellectual abilities than they are usually given credit for” (DOE 2003:19–20). Throughout the FP, the Revised National Curriculum Statement (Grades R–12) aims to produce learners who are critical and creative thinkers that can identify and solve problems, and who have the ability to “collect, analyse, organise and critically evaluate information” and make suitable, responsible decisions (DBE 2011b:5).

\(^2\) Any sources that were published prior to 2009 were distributed by the former Department of Education (DOE), and any sources that have been published since 2009 have been distributed by the Department of Basic Education (DBE). The DOE is the predecessor to the DBE.

\(^3\) Grade R is excluded, as it is not compulsory and differs significantly from the other FP grades.
2.2.2 THE FOUNDATION PHASE CURRICULUM

As explained before, the SA education policy has undergone three major revisions since 1994. The education system has in turn relied on Curriculum 2005, the National Curriculum Statement (NCS), and – most recently – the Revised National Curriculum Statement (RNCS) alongside the Curriculum Assessment Policy Statements (CAPS). As mentioned before, the CAPS revision saw a change in curriculum (what is taught) as opposed to teaching methods (how it is taught) and is thus still founded on the principles of outcomes-based education (OBE), which focuses on learner-centred pedagogy and a more active and critical approach to learning. The DBE provides all the resources required by teachers, from assessment guides, to planning resources, to guidelines for developing lesson plans and work schedules, to resources they can use in the classroom.

2.2.2.1 AN OVERVIEW OF FOUNDATION PHASE SUBJECTS

The four subjects that form the curriculum for FP learning are Home Language, First Additional Language, Mathematics and Life Skills. Each subject is divided into content areas or skills, which are further broken down into specific topics (Du Plessis 2013:10). Throughout the FP learners have between 23 and 25 hours per week dedicated to formal teaching time. A suitable breakdown of this time is provided for teachers, but approximately 7 hours per week are allocated to each Home Language, Mathematics and Life Skills, and the remainder (between 2 and 4 hours) is dedicated to First Additional Language (DBE 2011e:15).

The two language subjects focus on language acquisition and development, with the Home Language (HL) further focusing on the various forms of subsequent communication that stem from this, and the First Additional Language (FAL) focusing on developing a comprehensive understanding and proficiency in the second language as a tool for communication. The literacy subjects further enable creative, critical and reflective thinking while also encouraging the processing and communication of information (DOE 2003:28). In both language subjects, learners are assessed according to their achievement of the following independent skills: listening and speaking; reading and phonics; and writing and handwriting (DBE 2011b:8). Integrated into these language skills are thinking and reasoning, and language structure and use (DBE 2011b:8). The two language subjects are further explored in the Section 2.2.2.2.

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4 Even though curriculum policy prior to the CAPS amendment encouraged the learning of an additional language in the FP, 2009 figures showed that less than 5% of all learners were, in fact, introduced to an additional language prior to the Intermediate Phase (DBE 2010:20). However, with the CAPS amendment, the teaching of an additional language is now compulsory from Grade 1, which means that, starting in 2014, all FP students should be learning an additional language.

5 In addition to these subjects, the DBE (2012b:7) also requires “that all learners [need to study] an African language for a minimum of three years by the end of [Grade 9]”, however this policy is still in the process of being implemented.

6 The Home Language subject should reflect the LOLT.
The Mathematics subject develops mathematically related knowledge and skills that can be applied to the learners’ daily lives (DOE 2003:29). Although Mathematics focuses on the acquisition of critical skills and setting a foundation for developing a more in-depth competence in the subject in later years, it also plays an important role in developing problem solving and reasoning abilities (DBE 2011d:8).

The Life Skills subject focuses on the holistic development of learners and is concerned with the social, personal, intellectual, emotional, and physical growth of learners (DBE 2011c:8). The Life Skills subject develops a set of core skills that allows learners to develop to their full personal potential (physically, socially, cognitively and normatively) in order to participate effectively in society as an empowered citizen and creative thinker, and to be engaged in wide social and economic involvement (DOE 2003:73). This subject ensures that foundational skills, values and concepts are taught and developed in order to prepare learners for the new subjects that are introduced in the IP (DBE 2011c:8). The DBE (2011c:8) describes Life Skills as a “cross cutting subject” that supports and strengthens the teaching of literacy and numeracy subjects. Throughout this subject, learners also develop a critical understanding of different kinds of prejudice and how this has negatively impacted on SA society, and in lieu of this they are taught to “exercise their constitutional rights and responsibilities, to respect the rights of others and to show tolerance for cultural and religious diversity in order to contribute to a democratic society” (DBE 2011c:9; DOE 2003:74–75). Learners are also “encouraged to appreciate the multilingual nature of SA society and to develop a wide range of different communication strategies”, which links the subject back to literacy and the study of an additional language (DOE 2003:74–75).

The DBE believes that these four subjects are comprehensive and suitable to fully prepare learners for the IP of education, where they are introduced to a variety of additional subjects. The department also maintains that the four subjects should complement and reinforce each other by “drawing on the concepts and skills acquired in the other”, which allows the opportunity for the teaching of literacy and language to be incorporated into other subjects (DBE 2011c:8; DOE 2003:28–29).

2.2.2.2 LANGUAGE AND LITERACY IN THE FOUNDATION PHASE

The DOE (2003:41) defines ‘literacy’ as a “cognitive process that enables reading, writing and numeracy”. The purpose of both the home and additional language subjects is to “enable learners to communicate effectively either in spoken or written/visual format” (DOE 2003:41). The literacy subjects teach learners to process information, communicate ideas comprehensively, establish relationships, how to access and interpret information, and how to express themselves (DOE 2003:41). Throughout the FP the language subjects allow learners opportunities for critical and creative thinking as well as self-expression, and encourage the development of a positive attitude towards language skills (DOE 2003:42).
The four main language skills that are developed during the FP (in both the Home Language and First Additional Language subjects) are listening, speaking, reading and writing, and the ability to think and reason, and the development of language structure and use are integrated throughout these content areas (DBE 2011b:8). The listening and speaking skills are particularly important when the additional language is introduced, with the reading and writing skills given more attention in later years (DBE 2011a:11; DOE 2003:47).

At FP level, the language of the Home Language subject is integrated across the entire curriculum, as the HL should reflect the language of learning and teaching (as stipulated in the LIEP) and is thus used for reading, writing and oral interaction in all other subjects (with the exception of the First Additional Language) (DBE 2011b:8). This means that language skills can also be developed within the Mathematics and Life Skills subjects, and the development of language skills concurrently aids in both the learning and teaching of the other subjects, thereby allowing for the DBE’s integrated approach to teaching.

2.2.3 FOUNDATION PHASE TEACHING

Teachers play an indisputably crucial role when it comes to FP education; they are responsible for the facilitation of learning, communication of the curriculum, and holistic nurturing of students. FP teachers are likely to have the greatest impact on a learner’s schooling as they are charged with the crucial task of laying the foundation for all future learning (Gravett & Petersen 2014:ii). Furthermore, learner achievement is affected by how well learners are taught and encouraged in their early years, and this can have lasting consequences (Fleisch 2008:128). This necessitates that a portion of the literature be allotted to teachers within the SA framework. This section elaborates on the DBE’s stipulations regarding the role of teachers in the classroom, and starts with discussing teaching principles that are recommended by the DBE in order to ensure an effective and productive classroom environment. The section continues by identifying specific recommendations with regard to teaching FP learners, and with regard to teaching language. Hereafter, the section reports difficulties that stem from teachers themselves, and brings to light concerns with the teaching of language in particular. The disclosure of problems with teachers and teaching contributes to the understanding of the SA context. This, in turn, is vital, since facilitating the use of the proposed intervention is driven by teachers, and the product thus needs to be conducive to existing teaching methods and activities, and needs to accommodate for any shortcomings that may be present in the classroom.

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7 As previously explained, the majority of SA learners use an African language as the LOLT in the FP, and switch to English as the LOLT in Grade 4 (DBE 2011a:8). This requires them to reach a high level of competency in English, their First Additional Language – in terms of comprehension, reading and writing – by the time they exit the FP (DBE 2011a:8).
2.2.3.1 Teaching Practices

The basis of teaching falls on the acknowledgement that all learners learn differently⁸ – at a different pace, and through different methods, and with exposure to a variety of contexts – and that imparting the required skills is only possible if learning is not rushed, and if understanding is allowed to develop over time⁹ (DOE 2003:63). Teachers need to acknowledge that learning should occur through discovery and not direct teaching, and they need to adapt¹⁰ their teaching strategies (examples are provided by the DBE) and learning activities in order to meet the needs of all students (especially those who face barriers to learning – see 2.2.5) (MacBlain 2014 ch.10 sect.4; Schollar cited by Fleisch 2008:136). Teachers are also advised to bear in mind a learners' competence in the LOLT, especially when dealing with abstract concepts. In order to encourage effective teaching and learning, a teacher needs to believe that all learners are wholly capable of learning the basics of literacy and numeracy, and therefore able to become comprehensively literate and numerate (DOE 2003:63). Children should therefore never be ‘wrong’ – they should instead be allowed to arrive at answers through discussion and reflection (Schollar cited by Fleisch 2008:136). Teachers should also be particularly careful to ensure an anti-bias environment that respects diversity, where students are encouraged to develop a sense of shared identity and an understanding of human rights through open discussions (DOE 2003:80).

With regard to the setting of learning activities, teachers need to bear in mind that effective learning only takes place if the tasks that are set are of such a level that they present a challenge that engages children, but not to the point where learners are discouraged from attempting it (DOE 2003:64). Children must be able to identify the value of the tasks that they are completing – be it an acknowledgement of personal development, or solving a problem with real-life implications. Teachers need to focus on encouraging active learning, instead of resorting to finding ways to keep children busy (MacBlain 2014 ch.10 sect.4). Effective learning also stems from teachers themselves having a “deep and coherent conceptual understanding” of the subject – following predetermined steps and rote learning do not promote comprehensive understanding, however it can be facilitated through discussion of meaning amongst peers or with the teacher (DOE 2003:64).

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⁸ It is important to note that outcomes-based education, which was heavily criticised in Curriculum 2005, is still relevant in the current curriculum, even though it has been mitigated to some extent (Du Plessis 2013:1). Du Plessis (2013:1) notes that both the Revised National Curriculum Statement (RNCS) and Curriculum and Assessment Policy Statements (CAPS) revisions were merely adjustments to what is taught (the curriculum) and not how it is taught (the teaching methods). Du Plessis (2013:1) continues that the curriculum – as it stands now – has been written in content-format as opposed to outcomes-format, which means that the DBE runs the risk of teachers returning to “traditional [teaching] methods rather than OBE methods”, which focus on inclusive and learner-centred teaching.

⁹ This section focuses on teaching practices, whereas 2.3 investigates various aspects of learning.

¹⁰ However, as mentioned before, this does contradict government-issue workbooks and guidelines that stipulate time-driven progression.
2.2.3.2 Teaching Foundation Phase Learners

In order to learn effectively, young children should not be needlessly intimidated (for example, by tests or exams) and classroom humiliation should be avoided at all costs (DOE 2003:28). Young children tend to become nervous when rushed to complete tasks and are easily distracted, which means that effective teaching strategies should rely on actively involving learners in classes rather than expecting them to listen passively (DOE 2003:19). Children need to be given time to learn from their mistakes, rather than adults intervening at the first signs of struggle (MacBlain 2014 ch.10 sect.4). Teachers also need to recognise the fine balance of ascribing tasks that fit the learners’ abilities; tasks that are too easy do not promote learning, and tasks that are too hard “create a sense of helplessness and fear” – either way teachers face consequences of discipline problems (DOE 2003:19). Finally, FP learners benefit from following a daily routine, as this introduces them to the structure of the formal schooling environment (DOE 2003:28). This topic is further discussed in Section 2.3.2.

2.2.3.3 Teaching Language

A language is learnt spontaneously, through listening to and interacting with others, and is practiced and developed through play, stories and continuous stimulation (DOE 2003:50). Literacy development is encouraged through guided interactions with reading and writing, and exposure to various print, audio and visual media. Children are continuously developing their listening and speaking skills on their own, since this is part of how they learn a new language and use it to communicate with others (DBE 2011b:10,11; DOE 2003:50). These skills are further developed throughout the school day through informal oral interaction (checking attendance, talking about the weather) as well as focused activities that are integrated with content areas from other subjects (DBE 2011b:11). Reading and writing skills also typically develop through integration with other subjects, however the DBE (2011b:11) emphasises the importance of having specific, focused lessons that aim to teach and develop these skills. Both reading and writing skills are developed through a combination of shared, group, paired and independent tasks that simultaneously teach spelling and grammar (DBE 2011a:12; DBE 2011b:11). Independent reading tasks in particular provide opportunities for learners to practice reading and thereby improve their fluency, expand their vocabulary, and pursue reading for enjoyment, which incites the enjoyment of further learning (DBE 2011a:12; DBE 2011b:14).

The SA curriculum’s guiding principle of literacy instruction is that literacy involves the “gradual process of improving various language-related skills” (DOE 2003:50). Mistakes should be expected and form a part of the learning process. Literacy skills improve as they are used more frequently and in more challenging contexts (DOE 2003:50). Throughout the HL subject learners are exposed to a
range of stories, poems, rhymes and plays\textsuperscript{11} that aid the development of their vocabulary, comprehension and text structure (DBE 2011b:11–12). Although a lot of this material is prescribed or recommended, teachers are at liberty to choose substitutional material that is contextually or culturally relevant, provided it is in accordance with the class’s reading level (DBE 2011b:11). The HL curriculum is based on the assumption that “learners come to school [in the first grade] able to understand and speak [their home] language”, and subsequently also makes provision that learners enter the FP with no prior knowledge of the FAL (DOE 2003:21). The skills that are taught in the FAL curriculum are the same as those taught in the HL curriculum, however the way in which and the degree to which these are taught differ from the HL requirements (DBE 2011a:8). Thus, for the FAL subject, learners are exposed to texts and resources that are less complex and are dominated by illustration, until the learners demonstrate a concrete understanding of the additional language (DBE 2011a:8).

Learning an additional language is essentially the same as learning a home language, except that it happens later in child’s life, they are expected to learn it much faster, and they have the benefit of borrowing skills from their home language to aid the learning process (DBE 2011a:10). This concept is referred to as additive bilingualism, and is what the DBE supports throughout all phases of schooling (Hoadley 2016:36). The concept of additive bilingualism theoretically allows for skills (such as handwriting and phonics) to be transferred from the HL to the FAL, and means that children should also be able to extend their knowledge of the HL to academic contexts taught in an additional language\textsuperscript{12} (DBE 2011a:8; Fleisch 2008:105; DOE 2003:21–22). The differences between the teaching of the two language subjects can be attributed to the fact that learners start school with a basic knowledge of their home language (and therefore reading and writing are taught on the basis of the oral familiarity) however, as previously mentioned, learners generally have no prior experience with the FAL (DBE 2011a:8). For this reason, the curriculum skills for the FAL need to be approached in a much simpler, slower, elementary manner that initially focuses on listening comprehension instead of spoken ability and literacy (these are emphasised more in Grades 2 and 3) (DBE 2011a:11). Learners need to be ‘introduced’ to the language and build an oral familiarity with the new language starting in Grade 1. They need to hear a lot of the language, as it is used in context (for example, being read stories from large illustrated books, or being given easily understood

\textsuperscript{11} The CAPS documentation provides a list of recommended books, texts and resources that are suitable for the FP and ensure that the level of vocabulary and ideas advance through the grades. The First Additional Language CAPS document also provides educators with lists of the most common words found in SA children’s storybooks, which acts as a guideline of the core vocabulary that learners should acquire in the additional language (DBE 2011a:87).

\textsuperscript{12} Essien (cited by Dale-Jones 2013) does however warn that although bilingualism carries many benefits, cognitively beneficial bilingualism is only achieved if a person’s HL is adequately mastered and developed, and that the HL cannot be neglected in favour of promoting the FAL. For instance, children are required to develop a strong reading proficiency in their FAL (especially if it is English) and this directly depends on first developing strong reading proficiency in their HL (Jackson et al. 2016:5).
instructions complemented by gestures), and as their understanding grows learners need to be given ample opportunity to practice speaking the language (DBE 2011a:8,11).

### 2.2.3.4 Difficulties With Teachers in South Africa

One of the biggest underlying problems faced by the SA education system is the inferior quality of teaching (UNICEF 2012). Fleisch (2008:121) echoes these sentiments, and believes that the fundamental problem of the SA education crisis can be attributed to what happens inside the classrooms of the nation. Fleisch identifies a number of pedagogical problems that are generally, but not exclusively, associated with schools that serve poor communities and contribute to poor learner achievement. This relates to the bimodal distribution mentioned in Section 1.2.4, and the unequal distribution of wealth, educational resources, and achievement, which typically results in impoverished schools being most affected. Gustafsson et al. (2016:8–9,65) concur, and notably two of their four ‘binding constraints’ (see Section 1.2.4.3) relate to the capacity and accountability of teachers.

The chief problems that stem from teachers are weak content knowledge\(^\text{13}\) and poor pedagogical skills (Gustafsson et al. 2016:8–9,44,46; Hoadley 2016:57). A “lack of basic linguistic knowledge” with regard to reading in particular, contributes to the poor teaching of both the language subjects in the FP, especially if the FAL is unfamiliar to the teacher (Murray cited by Hoadley 2016:37; Jackson, McKay, Murray, Pretorius & Spaull 2016:10). Furthermore, teachers being proficient and fluent readers in both their home and additional languages can have a profound effect on learners, as it is the epitome of setting a good example (Fleisch 2008:122). When the teacher’s own subject knowledge is weak, they also tend to revert to “teaching to the slowest learners [as] a way of coping” by providing tasks that are insufficiently demanding and do not challenge the students (Howie cited by Fleisch 2008:130; Hoadley 2016:37). Essentially, this is due to the fact that teachers are unable to “effectively teach what they do not know themselves” (Gustafsson et al. 2016:44). Furthermore, teachers who were trained for the old curriculum, or who lack confidence in their own skills, are unwilling to engage with new instructional materials in order to move away from residual teaching methods (usually rote learning and teaching, or strategies that involve repetition and chant learning\(^\text{14}\)) (Carnoy, Chisholm, & Chilisa cited by Gustafsson et al. 2016:47; Hoadley 2016:37; Fleisch 2008:134). Similarly, some teachers believe that children only learn when engaged in certain

\(^{13}\) For instance, a recent study showed that nearly 80% of Intermediate Phase teachers in Grade 6 proved not to have the required content knowledge to teach their subject (Venkat & Spaull cited by Gustafsson et al. 2016:8).

\(^{14}\) Chant-learning and recitation do not teach children anything unless the teacher explains the ‘meaning’ or places it in context (e.g. numbers, times tables and letters of the alphabet) (Fleisch 2008:65). Without the ability of ‘meaning making’ children are not suitably prepared for the Intermediate Phase (Fleisch 2008:65). Furthermore, such teaching strategies are only conducive to communal teaching, and do not allow for individualised attention (Hoadley 2016:37,57).
tasks, such as completing worksheets, and do not trust that children learn holistically (Coetzee, cited by UNISA 2012). Many teachers who do not have regular access to training programmes do not have strategies in place to ensure that children understand the curriculum content (especially regarding the concrete representation of abstract concepts) and they do not understand the assessment terminology that has been introduced in the current curriculum (Coetzee, cited by UNISA 2012; Fleisch 2008:119).

The amount of time devoted to academic instruction, and insufficient opportunities to learn, are also notable areas of concern (Gustafsson et al. 2016:8–9; Hoadley 2016:37,57). This is a hurdle that is most often faced by historically disadvantaged schools (Fleisch 2008:122). Although teachers spend a lot of time in the classroom, their time is not exclusively devoted to teaching or academic instruction; there tend to be interruptions, official and unofficial requirements, poor class management, and abundant repetition resulting in a slow pace of class\(^{15}\) (Fleisch 2008:126–127). Poor curriculum coverage in particular is due to inadequate time spent teaching, teacher absenteeism and insufficient opportunities for learning to occur (Gustafsson et al. 2016:47–49; Hoadley 2016:37,57).

Another problem that is evident in disadvantaged schools, is that teachers tend to have lower expectations of the learners, and by means of the golem effect\(^{16}\) low teacher expectations lead to poor learner performance (Fleisch 2008:129). Leadbeater and Wong (2010:iii) suggest that one of the reasons for underperforming educational systems (in both developed and developing countries) is due to an inability to “reach and motivate” portions of the population, which leads to “ingrained problems of low aspiration”. Howie, cited by Fleisch (2008:130), elaborates on this by drawing a link between how low expectations, low standards and low motivation all accumulate to result in a low standard of achievement and “pupils’ over-inflated opinions of their ability” being perpetuated. Hoadley (2016:37,51,57) further comments that SA classrooms are characterised by a lack of individualised teaching, comprehension not being optimised, little or no vocabulary development, and learners’ limited experience with, and exposure to, extended texts\(^{17}\).

Gustafsson et al. (2016:9) cite the 2007 McKinsey Report which rightfully states that the “quality of an education system cannot exceed the quality of its teachers”, and some indicate that inefficient

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\(^{15}\) Hoadley, cited by Fleisch (2008:127), calls attention to the fact that “there is a prevailing assumption … in the working-class school which says that the learners [themselves] should determine the amount of content to be covered within any given time period” rather than the teacher, or curriculum, determining this. This means that not only do disadvantaged schools spend fewer hours actually teaching, but that this time is then further hindered by the slow pace at which instruction occurs.

\(^{16}\) A self-fulfilling prophecy that is the corollary to the Pygmalion effect.

\(^{17}\) This relates to both reading and writing being restricted to isolated words or sentences, as opposed to paragraphs (Hoadley 2016:51).
and unknowledgeable teachers are the cause of the 'low ceiling' and poor achievement that embody SA education (Hoadley cited by Gustafsson et al. 2016:9; Fleisch 2008:121). Furthermore – as though to exacerbate this – the majority of weak teachers are concentrated in the poorest, and worst performing, schools in the country; thereby inferring that “inadequate teacher content knowledge in poor schools perpetuates a cycle of poor educational outcomes for students, further entrenching their poverty and weak labour market status” (Gustafsson et al. 2016:8–9). The methods, quality and ability of teachers are not the only problems that hamper learning and teaching, but so is the quantity of teachers – especially adequately trained and passionate teachers, and teachers who are willing to work in rural areas (Davis 2013; Pandor 2008).

2.2.3.5 CONCERNS WITH TEACHING LANGUAGE IN SOUTH AFRICA

In addition to the aforementioned difficulties stemming from teachers in South Africa, Jackson et al. (2016:5) emphasise that the teaching of literacy and reading in particular is diverse and complex, and that it may cause confusion among teachers, more so if the students and teachers are African language-speakers (Gustafsson et al. 2016:15). Fleisch (2008:104–118) subsequently refers to a number of reasons why African language-speaking children struggle with literacy and language learning, regardless of factors stemming from socio-economic backgrounds (see Section 1.2.4.4).

Due to a combination of the LIEP (as explained in Section 1.2.3.3) and the consequences of not teaching English comprehensively (in schools where the FP LOLT is typically an African language), teachers waste a lot of time reviewing and explaining basic concepts when children enter the IP (Probyn, cited by Fleisch 2008:104,108). The lack of English proficiency also results in passive and silent classes full of self-doubting and self-conscious students, due to children’s inability to express themselves in the language of instruction (Hoadley 2016:57). Furthermore, teachers resort to translating English medium classes into a language that their students understand in an exasperated attempt to advance with a class, which leads to ‘code-switching’ and language mixing that confuses children, and a reliance on low-level cognitive tasks which only encourage a “superficial mastery of the second language” (Fleisch 2008:107,109,118). If most teaching reverts to the mother tongue this poses additional learning problems, since all the textbooks, examinations and standardised tests remain in English, yet learners are left incapable of converting their knowledge into English contexts (Fleisch 2008:109). Access to inadvertent English-language resources (for instance, magazines, billboards, advertisements and other media) also plays a role, and disadvantaged urban schools are in a more favourable position for early exposure to English than their rural counterparts, as the volume of this infrastructure is more readily available in metropolitan areas; English is thus processed as an “additional” language, as opposed to rural environments where English appears as a “foreign” language due to limited exposure and access thereto (UNESCO 2014:34; Fleisch 2008:111).


2.2.4 Learning and Teaching Support Materials

The DBE is required to provide schools and teachers with a variety of Learning and Teaching Support Materials (LTSMs). These can be used across all the FP subjects to aid in the cross-over from the concrete to the abstract paradigm, and can include print, electronic or physical resources, such as workbooks, storybooks, learner and teacher guides, posters, word or board games, videos, physical models, drawing and painting media, educational toys, and play equipment (DBE 2011c:12–13; DOE 2003:37–38). The proposed design intervention is intended to be one such LTSM.

Fleisch cites some studies that controversially show that increased teacher resources do not necessarily equate to greater academic achievement, but that the availability of learning materials, (such as textbooks, computers, media centres, internet access and libraries) do however affect achievement\(^\text{18}\) (Crouch & Mabogoane, cited by Fleisch 2008:90; Gustafsson, cited by Fleisch 2008:93; Van der Berg, cited by Fleisch 2008:92). However, Fleisch (2008:130,132) continues by stating that these do not have to be high-cost investments, as merely increasing the “availability of textbooks… [is] one of the most cost-effective ways of improving primary school achievement”. Hoadley (2016:36) and Jackson et al. (2016:13) support this, and state that print-rich environments are significant contributors to the facilitation of language and literacy development. This section elaborates on the DBE recommendations regarding alternative resources and support materials (which informs the requirements for the proposed intervention) and the risks that arise alongside the use of LTSMs.

2.2.4.1 Recommendations for Alternative LTSMs

One of the most prolific learning barriers in SA schools stems from a lack of LTSMs; classrooms tend to be devoid of print and other support materials, and there is a “shortage of sufficient texts at a range of reading levels” (Hoadley 2016:51,57). This is not a problem that stems from the learners or the teachers, but rather from the government’s inability to provide adequate resources and infrastructure to all schools. Schools that are located in either rural or disadvantaged communities tend to be more prone to facing such administrative or logistical learning barriers (Jackson et al. 2016:5). In order to compensate for the lack of adequate text-based resources, teachers as well as students are encouraged to collect reading and visual materials from appropriate resources such as magazines, newspapers, flyers and posters, or apply for the redistribution of such unsold materials, or even create their own texts or text-based resources (DOE 2003:36–37). The pertinence of this

\(^{18}\) Sample sizes for all studies conducted in an attempt to determine the effect of resources on achievement have been quite small, and as a result all deductions and conclusions should be followed with caution (Fleisch 2008:88). When it comes to proving that more resources result in preferential achievement most researchers are “cautious about moving from evidence of a statistical relationship to claims about a casual connection” especially due to the inability to enforce random student selectivity – this holds true for both sides of the argument (Fleisch 2008:89).
problem to the study is threefold: it contributes to the understanding of the SA context, it validates the necessity of alternative resources, and the ensuing DBE recommendations contribute to delimiting the design specifications of the proposed intervention.

In addition to compensating for government failings, teachers are encouraged to collect and develop their own resources, as these might be easier for the teacher to explain due to context, or more appropriate in supporting a teacher’s teaching methods, or better at targeting individuals’ specific needs (Jackson et al. 2016:5; DOE 2003:37). When selecting or developing their own LTSMs, teachers need to consider the following factors: learner-centeredness; allowing for both enrichment and remediation; age-appropriateness; the level of ability across the class; capturing and maintaining interest; and, avoiding bias and encouraging positive attitudes towards diversity (DOE 2003:37).

2.2.4.2 THE RISK OF RELYING ON SUPPORT MATERIALS

LTSMs are important additions to the FP classroom in terms of both teaching and learning, but it is necessary to note that even though they are used to support teaching and learning, they cannot be used in isolation, nor can they be used as a replacement for the curriculum (DOE 2003:37). Van der Berg, cited by Fleisch (2008:92,96), points out that “resources matter conditionally”, by which he means that schools do not always convert resources into outcomes. The DOE (2003:37) echoes these concerns, by stating that the success of these supplied resources is “determined by the teacher’s ability to use [them] appropriately and effectively in the learning context”, and that the “mere presence of [LTSMs] in a learning activity does not automatically mean that it is an effective learning tool”. The absence of LTSMs from classrooms is an unmistakable barrier to learning, however their presence can also be a hindrance if they are used in an irresponsible or incoherent manner that inhibits understanding or hampers the learning process (Fleisch 2008:96,122; DOE 2003:38). This needs to be kept in mind throughout the process of designing the proposed intervention; the product can only be expected to act as a support device, and it cannot be expected to replace any part of the curriculum.

2.2.5 LEARNING DIFFICULTIES

There are a vast number of learning difficulties that can affect a child throughout their school career. Within the SA context, a great number of these stem from, or are exacerbated as a result of, poverty (as mentioned in Section 1.2.4.4). As previously mentioned, problems that stem from poverty can manifest as insufficient income, poor health and nutrition, access to support materials and other resources, insufficient teacher qualifications, and inadequacies in the home environment (such as parental literacy or learning culture) (Fleisch 2008:32–50,121; Reddy, cited by Fleisch 2008:12). In addition to these, learning difficulties can also present as: physical disabilities and special needs; reading and writing problems; or subject-specific and conceptual barriers. Furthermore, problems stemming from teachers, LTSM reliance, language, and the transition of the LOLT have also been
elaborated upon throughout various preceding sections. If learners (from both advantaged and disadvantaged backgrounds) are affected by any of these difficulties in the FP, chances are these problems will transpire throughout their education, unless they are attended to.

The FP is a critical stage at which to identify any learning difficulties or barriers to learning that children might be facing. Teachers need to be able to identify any such barriers, and they need to know how to address or overcome these (Jackson et al. 2016:13). If teachers have a sound understanding of how to recognise and address learning barriers, they can plan for diversity within the classroom, and are able to ensure inclusivity and a non-discriminatory environment (Motshekga 2015c; DOE 2003:81). Any learning difficulties need to be addressed in such a way that does not intimidate the learner or make them self-conscious, and that caters to their individual needs (DOE 2003:34).

2.2.6 RESEARCH LIMITATIONS

The literature on FP education predominantly discusses findings regarding the curriculum requirements and teaching guidelines that are made available to schools and learners. This section also makes significant reference to the information that is presented in the contextualisation section (1.2), and identifies additional factors that may contribute to learner underachievement, in terms of teaching practices and LTSMs. It is however, as Fleisch (2008:139) points outs, still impossible to undeniably determine what causes the bimodal distribution of achievement or how to resolve it. This research limitation is a major hurdle in narrowing the achievement gap and ensuring consistent, quality education for all learners. The three foremost factors that have been identified are: teachers and ineffective teaching practices, changing policies and curriculum reform (see Section 1.2.2.2), and inadequate attention given to the teaching of English at FAL level in the FP. As identified in Section 1.5, the scope of this study is limited to supporting the acquisition of an additional language in the FP (with a focus on English), however consideration of the other factors when designing the proposed intervention would result in a more successful product.

2.2.7 CONCLUSION

Throughout this section, it is evident that the DBE has a clear and comprehensive plan of what it wants to achieve throughout the FP, but that their strategy is bound to be hampered by the persistent bimodal distribution of wealth, resources, and quality of education, all of which contribute to poor academic performance (as mentioned in 1.2). Even though there have been incremental improvements, the state of education in SA is still alarming, especially considering how much the government contributes to the sector financially (Gustafsson et al. 2016:14). The integration of the CAPS revision to the curriculum framework is likely to have the biggest influence on the FP, as well as the subsequent phases of education, predominantly due to the earlier introduction of an additional language, which facilitates the transition to a new LOLT in Grade 4. Although the CAPS revision is
clear and easily understandable, and has the right intentions, only time will tell if it is effective, and whether or not the earlier introduction of an FAL has an impact on further learning.

2.3 UNDERSTANDING CHILDREN AND HOW THEY LEARN

The second field of discussion for this study is understanding children, as well as how they learn. It is important to explore the development of children, as well as understanding how they learn, in order to design a product that contributes to their growth, that appeals to them, and that is beneficial to their learning process. It is particularly important to recognise that children differ on a basis of physical development, learning, and communicating, and that the design of any product needs to accommodate for such differences. An understanding of children and how they learn allows for a contextualisation within which to develop a product that enhances a child’s development, and aids in facilitating the learning process. Furthermore, this section, alongside the preceding section, allows for a more comprehensive understanding of the end user, and how the proposed intervention can support the teaching and learning of an additional language.

This section is divided into topics that discuss child development, an overview of learning, and the most important aspects of learning. The first section (2.3.1) discusses the various developmental stages that children go through. This allows for delimiting design requirements for products that are aimed at specific age groups based on knowledge of how children behave, act and develop at different stages. The next section (2.3.2) starts examining how children learn, by defining what is meant by ‘learning’, summarising a common understanding of how learning occurs, highlighting aspects of additional language learning, and investigating how children can be encouraged to learn. Insight into the learning process, especially with regard to additional language acquisition, is a pertinent topic that informs the design requirements of the proposed intervention, especially within the framework of the aforementioned concept of additive bilingualism. Section 2.3.3 further elaborates on learning, by exploring the most important aspects to ensure successful learning, including acknowledgement of the individual, allowing for incremental learning and allowing for unstructured play. The final topic follows on from this by elaborating on the importance of play in a child’s development, and the crucial role that this has in the learning process (2.3.4), whereafter the section concludes by identifying the research limitations (2.3.5).

Sean MacBlain’s *How Children Learn* (2014), which analyses the learning theories of various researchers and philosophers, and how these are applied in context, forms the basis of the literature regarding child development, and understanding how children learn. Although MacBlain’s discussion of various theories is comprehensive and insightful, the studies he draws from are predominantly based in the UK, and cannot necessarily be generalised or applied to SA contexts. *Educating Language-Minority Children* (1997), edited by Diane August and Kenji Hakuta, likewise serves to
inform the understanding of learning, with particular reference to additional language acquisition. John Holt’s seminal work, *How Children Learn* (1983), also contributes to this literature, as Holt’s insights into the child’s mind have had considerable influence on education practitioners and on making both schools and homes better places for children to learn. *Ergonomics for Children: Designing Products and Places for Toddlers to Teens* (2008), edited by Rani Lueder and Valerie Rice, is an influential work in the field of design for children; it also elaborates significantly on various aspects of child development, and the importance of play during childhood, and as such reference to their book is also made within this section of the literature.

### 2.3.1 Child Development

Before designing a product that is meant for children\(^\text{19}\), of any age group, it is important to understand the different developmental stages that they go through, and how their learning is affected throughout these stages. All children tend to pass through the same universal stages of growth and development, regardless of their culture, heritage or individual differences (Beran & Brown 2008:14). Knowledge of this aids in predicting the ways in which children act and react in the different stages, which in turn helps with specifying design requirements for products that are aimed at specific age groups. Throughout childhood, children develop physically, cognitively, emotionally, and socially, and it is necessary to explore all these aspects in order to design a product that supports growth in these areas.

#### 2.3.1.1 Physical Development

Once children reach middle childhood (between the ages of 5 and 6) they start to fully develop their fine and gross motor skills (Beran & Brown 2008:23,27; Hanna 2008:760; Lueder & Rice 2008d:425). During this stage movement is deliberate and although it might start clumsily it gets more attuned over the years (Torres 2008:490). Children in the earlier years of their FP enjoy testing newly acquired physical skills and dexterity, and like to test their strength in a quest to establish their independence (Lueder & Rice 2008d:424). In the early years of middle childhood children start mastering skills such as endurance and hand-eye coordination (Kagan & Gall, cited by Beran & Brown 2008:27; Lueder & Rice 2008d:424), however they may experience difficulties in “estimating speed, movement, and distance” (Ankrum & Fostervold 2008:103; Lueder & Rice 2008d:424). It is during this stage that children also start to display self-care skills, and that they develop the physical capabilities of participating in organised sports (Beran & Brown 2008:25,27). As FP learners get older their ability to integrate physical and cognitive skills becomes better, and they can start participating and paying attention to more facets of a specified activity (Boucher 2008:237).

\(^{19}\) For the remainder of this dissertation, the term ‘children’ refers to children who fall into the FP age classification, and the literature will focus on children aged 6–9 in particular.
2.3.1.2 **COGNITIVE DEVELOPMENT**

Between the ages of 6 and 8 children start to display “higher-level … academic skills” (Hanna 2008:760). Towards the end of early childhood children should be able to answer simple questions and tell stories in their mother tongue (Owens, cited by Beran & Brown 2008:24), and it is also during this age (6–7) that children start to express an interest, and hopefully enjoyment of, reading (Beran & Brown 2008:26). Provided children have had adequate guidance throughout early childhood, their reading, writing, and language skills should show more complex ability (Beran & Brown 2008:28) and they are using their communication skills for more than listening and talking (Torres 2008:489). Their reading skills are still in the early stages, and these children tend to ignore lengthy instructions in favour of resolving tasks on their own (Hanna 2008:761).

Children entering the FP show an increased ability in problem solving and reasoning, and have a longer attention span – both of which improve as the children mature (Beran & Brown 2008:29; Lueder & Rice 2008d:424–425; Torres 2008:490). From Grade 1, learners should start to understand and acknowledge the viewpoints that other people might have, and they start to apply basic logic to problems, however the abstract realm is still unfamiliar to them (MacBlain 2014 ch.2 sect.4; Beran & Brown 2008:26; Lueder & Rice 2008d:425; Torres 2008:481). Learners at this age do however respond or assess subjectively rather than objectively, and as a result can appear to be egocentric (DOE 2003:20). Although children might have a basic grasp on logic at this stage, the development of foresight and understanding consequences to their actions only develops much later (Beran & Brown 2008:26). During middle childhood children take pride in their accomplishments, and enjoy ‘teaching’ others the skills or knowledge they have acquired (Hanna 2008:761; Pollock & Straker 2008:797).

2.3.1.3 **EMOTIONAL DEVELOPMENT**

Throughout middle childhood children become progressively more independent, however they are still sensitive and emotionally vulnerable (Beran & Brown 2008:23). Children are particularly sensitive to emotion, and will exaggerate emotions expressed by adults (Holt 1983:23). During this stage incremental success, acknowledgement and accomplishment are critical for development, self-esteem and motivation (Boucher 2008:238). In the later FP years, learners become more adventurous, restless and more willing to engage in risky behaviour, and succeeding in daring acts is a means of dealing with fears and boosting their self-esteem (Beran & Brown 2008:28; Boucher 2008:237; Lueder & Rice 2008d:425). As their self-esteem increases throughout the FP years, children start showing a tendency towards self-centeredness, and they brag and talk a lot, however they find criticism or failure difficult to handle, and as such any critique needs be handled sensitively (Beran & Brown 2008:29).
Once children enter the formal schooling environment the resulting rules and rituals provide a sense of comfort and stability (Beran & Brown 2008:28). It is from Grade 1 onwards that children do in fact start showing appreciation for, and an inclination towards, following rules and rituals (of a classroom or in a game) (MacBlain 2014 ch.3 sect.5; Beran & Brown 2008:25; Hanna 2008:761; Lueder & Rice 2008d:424). As a result of this, children start accepting responsibility for their actions, and start being involved in structured and competitive sports activities (especially those that are team-oriented) – which coincides with their improved physical capabilities (Boucher 2008:238; Hanna 2008:761).

At this age, children express a desire to improve their skills in order to more successfully control and manipulate their surroundings, however they might feel humiliated or frightened if they are not successful in their ventures, or if they are put under social pressure to provide an answer or execute an action that might be ‘wrong’ (Beran & Brown 2008:25; Holt 1983:25,65). This type of reaction becomes more prevalent as children mature. Children do not develop an urgency to get something right at the first try until they are older – as young children they are willing to persist and to “imitate, compare, and correct” their actions until they are satisfied (Holt 1983:21). Children want to create and do to the best of their abilities – not to “please someone else but to satisfy themselves” (Holt 1983:21). As children get older (starting in the FP) they start to exhibit more frustration with not being able to achieve immediate success, due to the more competitive nature of a formal classroom environment (Holt 1983:27). When children do give in to defeat or failure it is better to reduce the pressure they feel, and to reassure them and give them time to reattempt the task, rather than to urge them on (Holt 1983:28).

2.3.1.4 SOCIAL DEVELOPMENT

Children entering middle childhood constantly need to be empowered to “participate, communicate, and innovate”, and they are dependent on those around them for this support (IDEO [sa]). It is because of this that children learn to belong to ‘communities’ (such as families) from a young age, and through this they learn how to interact with both peers and adults (MacBlain 2014 ch.9 sect.2). Once children enter the formal school environment, they start seeking social acceptance and acknowledgement from people other than family, and start taking greater enjoyment in the various levels of social interaction (Beran & Brown 2008:23; Torres 2008:489). Although FP learners are starting to develop a need for independence, they also start placing high value on the opinions of their teacher and the acceptance of their peers (Boucher 2008:237–238; Lueder & Rice 2008d:425; Torres 2008:491). At this age, children become more sociable with children of their own age and, along with the need to be accepted, they start to form concrete friendships (Beran & Brown 2008:23,27,28; Hanna 2008:760). Throughout this phase, children are “highly social, dependent on peers for feedback, and [very] conscious of their relationship with the adult world” (Gaffney & Hunter 2011). Just as FP learners are easily influenced by their peers, they are also highly susceptible to media influences (Torres 2008:490). Along with the aforementioned inclination towards structured
activities, children learn improved social skills through sharing and taking turns (Beran & Brown 2008:25).

2.3.2 UNDERSTANDING HOW CHILDREN LEARN

Alongside understanding child development, it is vital to understand how children learn, and to use this knowledge to design a successful and useful product that supports the learning process, especially the learning of an additional language. Children learn through interactions with the people, products and environments around them (MacBlain 2014 Introduction), and this learning is centred around a “quest for meaning” (Gulland & Phillips 2008:803). Understanding the methods that children use to explore and subsequently understand their environments allows designers to accommodate for each stage of a child’s development, in ways that pose suitable challenges without posing any unnecessary risks (Beran & Brown 2008:37). In order to comprehensively understand this topic, this section starts by exploring what is understood by ‘learning’, and then continues with a discussion of the most widely accepted understanding regarding how children learn. Even though learning and teaching have been examined as they are interpreted by the DBE (2.2), they are discussed here in terms of broader reference. This section continues with an overview of special considerations regarding how children learn an additional language, and concludes with recommendations for how to engage children in learning.

2.3.2.1 DEFINING LEARNING

‘Learning’ can be defined as “the activity or process of gaining knowledge or skill by studying, practising, being taught, or experiencing something” (Shorter Oxford English Dictionary on CD-ROM Version 3 sv ‘learning’). However, MacBlain (2014 ch.1 sect.3) defines ‘learning’ as more than “acquiring new … knowledge within the classroom”, and instead describes it an active and intrinsic process through which new understanding is generated by “linking existing knowledge to new incoming information”. By this definition it deems that both children and adults learn by constructing meaning and understanding from “past or current events” and using this understanding as a guide to future experiences and resulting actions (MacBlain 2014 ch.3 sect.4).

As children develop basic skills, they draw on these to learn and master new skills – this is called incremental learning, or scaffolding (MacBlain 2014 ch.2 sect.5). Similarly, if a child fails to succeed in a task (whether it be through play or an academic activity), they use their knowledge of this failure to incrementally develop their skills until they are successful; if they are successful, they use this

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20 For an academic overview of four of the major educational theories that offer insight into how children think and learn, and how they are taught, please refer to Appendix C.

21 It is important to note that the development of any skill in this way can be considered ‘learning’. Learning need not be limited to traditional academic pursuits and contexts, but should rather be determined by a child’s developmental stage and the extent of their current skill set.
knowledge to improve their execution of the skill or task in future (Torres 2008:479). This basic method of learning is used by children and adults alike. Practice and repetition lead to mastery, and once a skill is mastered children begin to find pride and enjoyment in their accomplishments and thrive on such recognition (Torres 2008:478–489). Practice also encourages self-exploration of a child’s capabilities and limitations, which is why learning and child development are so closely linked (Torres 2008:480).

2.3.2.2 A COMMON UNDERSTANDING OF HOW CHILDREN LEARN

It is of common understanding that children do their most crucial learning before and during the FP, since they learn autonomously and are not under any pressure to follow any ‘correct’ ways of thinking that can be instituted by teachers or peers (Holt 1983:1). Children acquire knowledge prior to attending school without being formally taught without much difficulty, and Papert (cited by Holt 1983:136) believes it is only when children enter the formal teaching environment, and are exposed to rote learning, that aversions to learning start to emerge. Holt (1983:143) maintains that “children love learning and are extremely good at it”, but it is only through a thorough understanding of how children learn, and a careful combination of teaching and learning practices that children can be encouraged to learn.

Children learn in a variety of different ways throughout their development, especially through exploration strategies, such as mouthing, manipulation of objects, throwing and banging objects, combining and matching objects, representational play, and imaginary play (Beran & Brown 2008:30–36). Older children (FP learners), in particular, learn by testing their own limits and those of the products they have access to (Beran & Brown 2008:37). All forms of learning are essentially a combination of “struggling, exploring, discovering, practicing, problem solving, and [controlling]” through interactions with people, places and things, and many of these can be facilitated through play (Bruce, cited by Torres 2008:478). MacBlain (2014 ch.2 sect.5) states that play is “one of the most important foundations for learning”, and as such Section 2.3.4 is devoted to discussing the Importance of Play. Some other activities that are most suited to learning include: games and experiments, talking, reading, participating in sports, art and numeracy exercises, and fantasy play.

2.3.2.3 AN OVERVIEW OF ADDITIONAL LANGUAGE LEARNING

As with learning in general, there are a number of theories regarding how children acquire additional languages. Just as MacBlain (2014 Introduction) warns about learning in general, Larsen-Freeman (cited by Gitsaki 1998:96), in agreement with August and Hakuta (1997:14), caution that no single theory can indisputably cover additional language acquisition for all learners. Additional language acquisition is a complex process and due to the diversity of variables, different learners rely on
different strategies to support their language learning process\textsuperscript{22} (Larsen-Freeman cited by Gitsaki 1998:96; August and Hakuta 1997:14). Most theories regarding additional language learning tend to focus on nuances regarding the finer aspects of ‘how’ learning occurs, but common agreement corroborates most aspects of learning in general, that have already been discussed in the previous section. All theories that are mentioned support the understanding that additional language acquisition is a “gradual process” and all learners go through “various stages of development” (Gitsaki 1998:96), and all theories universally reject behaviourist theories\textsuperscript{23} of language learning (August & Hakuta 1997:15). August and Hakuta (1997:15,29) additionally emphasise the recurring concept of language transfer throughout various theories, “the effects of instruction” upon learning, as well as the unabated importance of the role of the home language in the process of additional language acquisition.

There are two additional factors worthwhile noting with regard to learning an additional language, and learning \textit{in} an additional language, especially within the SA context. Firstly, August and Hakuta (1997:20,30) caution that the transfer of skills when attempting to advance literacy of the additional language is complex, and that it relies on “not only the level of [home] language reading, but also the level and content of the [additional] language reading material”. Struggles with reading in the additional language may also be a result of “limited access to word meanings”, or unfamiliarity with vocabulary in the additional language (August & Hakuta 1997:20). Jackson \textit{et al.} (2016:5) emphasise the importance of vocabulary on language proficiency, and highlight this within the SA curriculum, with regard to both the home and additional languages\textsuperscript{24}. A good vocabulary contributes to better oral proficiency, listening ability, reading comprehension and writing ability, and also enhances general knowledge and self-confidence (Jackson \textit{et al.} 2016:12). The principles of learning vocabulary tend to remain the same irrespective of language, and vocabulary development is principally encouraged by reading\textsuperscript{25}, which is why the choice of reading material in the classroom is crucial (Jackson \textit{et al.} 2016:13). Secondly, August and Hakuta (1997:26–27,31) refer to three key matters related to content learning\textsuperscript{26}: subject matter specificity (subjects are structured differently, thus they are learnt differently), multiple forms of knowledge, and prior knowledge. The third of these is most pertinent within the SA context of additional language acquisition, as prior knowledge of the additional language (predominantly English) is the foundation of understanding the new content

\textsuperscript{22} August and Hakuta (1997:14) also do not refer to additive bilingualism\textsuperscript{22} (which is supported by the SA DBE) within the confines of any one theory.

\textsuperscript{23} See Appendix C for elaboration.

\textsuperscript{24} This is particularly pertinent to the SA context, as there is little or no vocabulary development in classes, and poor pedagogical and content knowledge are major contributors to poor vocabulary development (Hoadley 2016:51; Jackson \textit{et al.} 2016:2).

\textsuperscript{25} Additionally, the two fundamental ways of learning new words (in either the home or additional language) are through incidental learning (learning without intention) and explicit learning (learning with deliberation) (Jackson \textit{et al.} 2016:13).

\textsuperscript{26} This is a significant concern for learners entering the Intermediate Phase.
knowledge upon entering the IP, especially concerning the “actual meanings attached to new information” (August & Hakuta 1997:27).

### 2.3.2.4 Engaging Children in Learning

Children are naturally curious and have an innate desire to make sense of things and become competent in the abilities that allow them to explore these things and environments (Holt 1983:139). Because of this, young children do not necessarily need additional encouragement to learn, they merely need to be encouraged to explore their surroundings in order to fuel their curiosity (although this should not be done at the expense of safety) (Holt 1983:19). Children are typically “open, receptive and perceptive” and actively want to engage with that which surrounds them (Holt 1983:139). Learning – in both adults and children – is essentially motivated through passion, active interest, and enthusiasm (Holt 1983:140).

While children are still young they voluntarily and eagerly engage in learning activities, as it provides them with an opportunity to improve or hone their abilities. Children have the patience to wait for meaning, but the determination to try things immediately, even at the risk of failure; children are not afraid to make mistakes in their quest for understanding, and in so doing they acquire both patience and resilience (Holt 1983:139–140). Children are particularly eager to interact and communicate with adults, and imitate them in an attempt to do so (Holt 1983:139). All of these factors point to the fact that the minimum requirement for engaging children in learning is to provide an interesting and stimulating environment, and adult interaction or facilitation (Vredenburgh & Zackowitz 2008:909).

Children learn best when they are allowed to do so independently, can choose their own interests and are encouraged to “[decide] for themselves what they want to learn and how they want to learn it” (Holt 1983:141). Holt believes that “the things we most need to learn are the things we most want to learn” in an attempt to satisfy our own curiosity (Holt 1983:141; Holt, cited by MacBlain 2014 ch.1 sect.5). Holt (1983:142) believes that if children (and adults) learn in this way, they “learn both rapidly and permanently”, in contrast to rote learning methods, where knowledge and understanding do not necessarily remain. In terms of learning ‘content’, children are more responsive to work that is proposed as something that needs to be explored and understood, rather than “a list of facts to be learned” (Holt 1983:104). Provided a child has a keen interest in a specific topic, they are quite likely to pursue further learning independently, provided they have access to the necessary resources (Holt 1983:110). This pursuit of knowledge does however not limit them in their interests (as it often does to adults) but instead it expands their interests in related fields (Holt 1983:114). In the case that a child does seem to lose interest in an activity or topic, it may be because they are trying to build understanding in a different way, or because they are still coming to terms with new knowledge (Holt 1983:140). Children need time to internalise their greater understandings of the world, and provided
they are not rushed or under threat, they are very capable of finding and correcting their own mistakes (Holt 1983:140; Rousseau, cited by MacBlain 2014 ch.1 sect.5).

2.3.3 IMPORTANT ASPECTS TO LEARNING

When considering the learning process that children undergo, there are a number of factors that are repeatedly noted by philosophers and researchers in the field of education. The three most important factors that facilitate successful learning are: acknowledgement of the individual, allowing for incremental learning, and encouraging unstructured play. Although these three factors are the basis of successful learning, various educationalists advocate for the importance of additional aspects and their influence on a child’s learning.

2.3.3.1 ACKNOWLEDGING THE INDIVIDUAL

Acknowledgement of the individuality of children plays a significant role in their learning process, and advocates the necessity of child-centred education27 (Rousseau, Dewey, cited by MacBlain 2014 ch.1 sect.5). A child’s developmental stage – be it cognitive, physical, emotional or social – and the “concomitant … skills” have a significant impact on the learning process, and August and Hakuta (1997:15–17) draw attention to the influence of age, intelligence, attitude towards learning (which may be “overridden by the overwhelming importance of English to getting ahead in the society”), and personality on the process of additional language learning in particular.

2.3.3.2 INCREMENTAL LEARNING AND PRACTICE

Another fundamental aspect of the learning process is allowing children the opportunity to learn incrementally, and to build on previous successes (also known as scaffolding) (Beran & Brown 2008:37). It is also important to note that children do not learn by separating the act from the skills involved in the act – instead they learn by practicing the act itself, and learning the skills through participation of the act (Holt 1983:43). If attempting to teach by ‘teaching the skills’ as opposed to ‘practicing the act’, children would “become baffled, discouraged, humiliated, and fearful, and would quit trying to do what we asked them” (Holt 1983:44). Furthermore, adults like to believe that children can learn through explanations of their (the adults’) experiences (Holt 1983:132). However, it is often the case that a verbal explanation of a concept or object with which the adult is familiar, is not sufficient to convey meaningful understanding to the child, as the child does not have a frame of reference for the topic (Holt 1983:132). This fact is of particular pertinence to this research study, as the learning and teaching of an additional language is heavily dependent on both practice and verbal explanation. This also leads to the realisation that if one is to ascertain whether or not a child has

27 It must be noted that after the latest review some of the core values of outcomes-based education, such as the principle of progressing at one’s own pace, are no longer prioritised in the SA curriculum (Louw et al. 2012:1215).
understood a concept (and if the teaching practice has been successful), the child needs to be able to explain how they arrived at an answer or conclusion (Coetzee, cited by UNISA 2012).

### 2.3.3.3 PLAY

As early as the 17th century, philosophers realised that learning had to be enjoyable, and that children should be encouraged to learn through play (MacBlain 2014 ch.1 sect.5). Play is considered a critical component in a child’s development by many theorists, including Locke, Vygotsky, Montessori, Froebel, and Steiner, as it helps foster independence and confidence, and imparts a number of other skills that are critical to a child’s physical, cognitive and emotional growth (Vygotsky, cited by MacBlain 2014 ch.2 sect.5). Due to the significant role that play has in a child’s development Section 2.3.4 discusses the Importance of Play in more depth.

### 2.3.3.4 LANGUAGE

The role of language in education and learning has been discussed extensively in Section 2.2 FP Education, and this has been echoed by a number of seminal theorists, including Locke, Vygotsky and Bruner. Vygotsky in particular draws attention to language (both listening and talking) as a critical factor in developing a child’s understanding, as language is the most integral “means of transmitting meaning” (MacBlain 2014 ch.2 sect.5). Language is “central to the social and emotional development of children”, and if language use is limited in a home environment, children might have difficulty expressing their feelings and emotions due to limited opportunities for growth in these areas (MacBlain 2014 ch.3 sect 5, sect.6). MacBlain (2014 ch.10 sect.2) repeatedly emphasises the fact that children can only develop their learning (of language or other abilities) with appropriate adult support. Bruner also elaborates on the link between language acquisition and how this is followed with attainment of literacy skills (MacBlain 2014 ch.2 sect.6). In a school context, children are required to demonstrate their knowledge and understanding through written and spoken language, which means that not only is language required for attaining knowledge and understanding, but also for sharing or providing proof of such knowledge (MacBlain 2014 ch.3 sect.6).

### 2.3.3.5 TEACHING PRACTICE

The purpose of formal schooling has been deliberated by a number of philosophical authorities over the decades, but the three primary functions of schooling are considered: to encourage individual fulfilment, to prepare children for the working adult world, and to act as an agent of social progress (Chitty, cited by MacBlain 2014 ch.5 sect.1). Essentially, the purpose of education is to “[prepare] young people for becoming effective members of their communities” – a sentiment echoed by the SA DBE (Dewey, cited by MacBlain 2014 ch.1 sect.5). The role of teachers is of great importance in

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28 The role of language use in the learning and teaching of an additional language is particularly sensitive.
the quest to achieving this ideal, as teachers need to ensure that their pedagogic practices best allow children to attain this (Vygotsky, Bruner, cited by MacBlain 2014 ch.2 sect.7).

Teachers need to adjust their lessons according to the pace of each child in their class, which reflects the importance of acknowledging the individual (MacBlain 2014 ch.10 sect.4). Within the SA context, government-issue CAPS workbooks and worksheets allow little room for misunderstanding or misinterpretation of the learning outcomes, and they also stipulate a predetermined pace and sequence of work (Zenex Foundation 2013). Although this might be beneficial for time management and ensuring curriculum completion, it does not accommodate individual learners’ pace of learning, which is potentially problematic. For example, with regard to teaching reading, especially in the First Additional Language subject, different learners might be better suited for certain methods, which is why August and Hakuta (1997:23) encourage the use of mixed methods teaching approaches, but CAPS may not allow for this. Adapting teaching practices in order to suit a child’s developmental level, is what allows for a nurturing and supportive learning environment.

Good teaching practices also focus on encouraging active learning, instead of resorting to finding ways to keep children busy (MacBlain 2014 ch.10 sect.4). Jean Piaget, in particular, maintained that “children develop cognitively at different rates”, and that teachers need to engage children in tasks according to individual requirements, in favour of “attempting to accelerate [children’s] learning” by introducing content and activities that are too advanced (MacBlain 2014 ch.2 sect.4). If children are encouraged to actively engage with the learning process, they are more likely to experience self-motivation and a sense of fulfilment (MacBlain 2014 ch.5 sect.4). Furthermore, children need to be given time to learn from their mistakes, instead of adults (both teachers and parents) intervening at the first signs of struggle (MacBlain 2014 ch.10 sect.4). To resort to the use of fear, humiliation and reproach to teach or instil discipline is highly ineffective and can have very negative consequences on a child’s development (Holt, cited by MacBlain 2014 ch.1 sect.5). Teachers are responsible for nurturing a child’s emotional, social, and cognitive development, and in order to achieve this, teachers need to remove any barriers that affect a child’s development within the learning environment, or they need to provide the necessary support needed to facilitate the navigation of any such barriers (Piaget, cited by MacBlain 2014 ch.2 sect.4).

2.3.3.6 SETTING AN EXAMPLE

Vygotsky (cited by MacBlain 2014 ch.2 sect.5) argues that children are born with the ability to be taught through guidance from older siblings or adults, however Holt (1983:64) warns that children

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29 MacBlain (2014 ch.5 sect.5) reports that even in the UK there is concern that teachers focus extensively on delivery of curriculum content, and do not concern themselves enough with reflecting on the impact of their pedagogic practices. This shows that wavering pedagogic practice is not just a concern in the SA context.
need to learn in their own way, and any attempt to guide or correct them is by no means guaranteed to help them. This includes allowing children to use products for unintended purposes, or to change the rules of a game to suit them (Holt 1983:64,65). Children can, however, be encouraged to learn through ‘competence models’ (observing people who can do something better than the child can), but this runs the risk of being intimidating and discouraging (Holt 1983:65). Some theorists support the idea of ‘infant omnipotence’ (when young children believe they can do and accomplish anything), however Holt (1983:65) contrarily believes that children are, in fact, aware of how little they can do and how little they know, and warns that adults (both teachers and parents) need to realise that children can find their own ignorance a burden and even a humiliation (Holt 1983:65). Due to a combination of these factors, young children often learn much better from slightly older children or siblings, since their competence models are more achievable, and their language development is more familiar (Holt 1983:65).

2.3.3.7 IMAGINATION

Maria Montessori did not approve of children using their imagination, however Vygotsky and Holt both advocated the importance of fantasy during childhood (MacBlain 2014 ch.1 sect.5, ch.2 sect.5). Holt believes that indulging in fantasy is a very necessary part of childhood, and that it is not used to escape the real world (as Montessori believed), but rather to experience the real world, by pretending to be in ‘real life’ situations that are not available to children (Holt 1983:115,118). Children cannot always differentiate between fantasy and reality, and as such children use fantasy to learn about the world in two ways: to test reality in order to “enlarge the boundaries of their own experience”, and to make sense of reality since they have very little real experience to rely on (Holt 1983:40,120–122). Furthermore, Holt (1983:119) believes that children learn faster if they are allowed to play and interact freely with items and materials, as opposed to if they have to follow set guidelines (as stipulated by the Montessori model). Fantasy play is entirely spontaneous, and Holt (1983:126) warns that if children are asked to engage in fantasy on demand, they are likely to pretend to do so for the sake of the adult. It is however also important to recognise that unlike the early childhood phase, older children (nearing the end of the FP) prefer engaging in real activities (and sports) rather than pretend play (Beran & Brown 2008:27,28).

2.3.3.8 POTENTIAL NEGATIVE INFLUENCES

According to the United Nations Children’s Fund (2012) “[c]hildren are natural learners but their desire to learn can easily be undermined and destroyed by the many hardships they face on a [daily] basis”. Children are very susceptible to external influences, and their learning can be affected by a number of factors – most notably their social, cultural and physical environments (Noddings, Vygotsky, cited by MacBlain 2014 ch.2 sect.5). Children are especially prone to influence from their surroundings, and thus it is important that interactions with their surroundings and the people therein are meaningful, stimulating and enriching, in order to aid their development (MacBlain 2014 ch.3
In order to facilitate their learning process, children need to grow up in safe and nurturing environments (MacBlain 2014 ch.3 sect.4). MacBlain (2014 ch.9 sect.3) suggests that effective learning environments are predominantly determined by taking children’s differences into account and catering for these (in terms of language, culture, race and socio-economic backgrounds), and the extent to which teachers reflect upon and adapt their own pedagogic practices. Potential negative influences on a child’s learning can stem from detrimental home environments or socio-economic factors (including access to resources, nutrition, overcrowding, stress, and extracurricular activities) (Hughes & Tizard, cited by MacBlain 2014 ch.4 sect.2; MacBlain 2014 ch.9 sect.4).

2.3.4 THE IMPORTANCE OF PLAY

Playing is fundamental for childhood development, as it helps children develop on different levels – physical, cognitive, creative and socio-emotional – and it allows children to explore their environment and discover the relationships between objects, their environment and themselves (UNICEF 2014a:21; Boucher 2008:231; Lueder 2008:825; Torres 2008:479; Vredenburgh & Zackowitz 2008:910). Not only does play allow for testing physical capabilities and musculoskeletal development, it also encourages creative problem solving, expression of emotion or interest, sociability, cooperation, establishing relationships, and learning (MacBlain 2014 ch.3 sect.5; Boucher 2008:230,231; Lueder 2008:825; Torres 2008:479; Vredenburgh & Zackowitz 2008:910). Without play, children cannot foster their independence or learn about their limits (Vygotsky, cited by MacBlain 2014 ch.2 sect.5; Lueder 2008:825). Play is also an important channel of expression, especially for children who might battle to express themselves verbally (MacBlain 2014 ch.4 sect.8). Unstructured play in particular allows for interacting with peers from different cultures, relieves stress, allows for reflection and problem solving, and exercises children’s imaginations (Boucher 2008:231).

Three ‘types’ of play are widely recognised: physical play, object and fantasy play, and language play (Smith et al., cited by MacBlain 2014 ch.3 sect.5), however the U.S. Consumer Product Safety Commission (USCPSC) divides ‘play’ into seven categories. In approximate developmental order, these are: exploratory play, construction play, pretend play, game and activity play, sports and recreational play, media play, and educational play (Smith 2002:5). Play progresses as children get older and develop – representational play (such as a child-adapted toy used to represent the real object) advances to pretend play (where available objects are used as substitutions), and pretend play progresses from single realistic substitutions to more complex and creative scenarios (Torres 2008:480–481). As children get older their substitutions need to be more appropriate to their needs (Torres 2008:481). When they reach the FP, children plan and coordinate their symbolic play based on reality and they start following predetermined rules of engagement (Torres 2008:481). As children advance through the FP they become more attuned to symbolic meanings, pretend play becomes less frequent, and children revert to projecting fantasies onto dolls or stuffed animals, through
complex and extended storylines (Smith 2002:76). Typically, as children get older, both play and learning change from being unstructured to being more rule-based, and games become more enjoyable if they have objectives (Boucher 2008:230; Hanna 2008:761).

Irrespective of their age, all children seek stimulation from their environment and the products therein, and children often engage in play as a process of discovery and learning (Torres 2008:495). Play allows children the opportunity to explore and understand the world on their own terms, and thereby they master skills, develop self-confidence, and explore their creativity (MacBlain 2014 ch.4 sect.8). However, children only remain engaged in play if the spirit of the game remains fun – if it becomes outcome based or academic they tend to lose interest (Holt 1983:31). This is further discussed in the next section, which discusses the role of play in facilitating the learning process.

2.3.4.1 PLAY FOR LEARNING

As mentioned before, MacBlain (2014 ch.2 sect.5) refers to play as “one of the most important foundations for learning”, and throughout the centuries, progressive educationalists have encouraged the notion that play should form an integral part of academic life, as it ensures the social and emotional development of children alongside the traditional cognitive development sought in schooling environments (Ginsberg, cited by MacBlain 2014 ch.4 sect.8). Holt (1983:19–20), in particular, regrets that most people believe ‘education’ is synonymous with ‘schooling’ – which is associated with learning predetermined things under threat of failure or punishment if not complied with. Instead, Holt (1983:19) advocates for children to play foolish and joyful games, such as the “game of trying to find out how the world works, which we [refer to as] education”. Vygotsky (cited by MacBlain 2014 ch.2 sect.5) also highlights the importance of play in a child’s learning process, and refers to play as ‘self-education’.

Play is often considered a distinct activity since it is pleasurable, internally motivated, based on ‘pretend’, is spontaneous, and it is not governed by rules (Torres 2008:478). Play is therefore separated from learning and work; however, children cannot necessarily distinguish between the three (Torres 2008:478). It is important to remember that children are “curious, inquisitive and love to explore” (Smyk 2013) – they have a strong desire to play and tend to learn by doing (Brown 2014). Play is, fundamentally, fun, and it is something that children look forward to doing. Play is also very engaging. Combining typically dreary activities (such as physical education or learning) with play, is more likely to entice children to want to participate in an activity, and they are more likely to learn this way (Lueder & Rice 2008c:252; Torres 2008:479; Vredenburgh & Zackowitz 2008:909). However, as previously mentioned, if the play activity starts to focus on specific outcomes or academic evaluation, children are likely to lose interest (Holt 1983:31).
The development of any skill through play can be considered ‘learning’ – it need not be limited to traditional academic pursuits, but should rather be determined by a child’s developmental stage. For instance, critical skills – such as problem solving, creativity, visual perception, aural abilities and even language development – are all supported through play, and can be cultivated throughout a child’s development (MacBlain 2014 ch.3 sect.5; Torres 2008:478). Play is very often associated with either toys or games, and children engage with toys if they are intrigued, and remain engaged as long as they are entertained or having fun (Torres 2008:478; Holt 1983:31). However, as with academic tasks, activities, toys, and even expectations, if a play activity is set beyond a child’s developmental level, this can provoke anxiety, self-doubt and an inclination to giving up (Boucher 2008:237). Children also often invent their own games from seemingly nothing, and many are started accidentally, and should be encouraged – the more play is encouraged; the more learning is likely to occur\(^{30}\) (Vredenburgh & Zackowitz 2008:909; Holt 1983:19). Encouraging learning through play-related products and activities can be hugely successful if children are empowered by allowing them to take control over their own enjoyment.

2.3.5 RESEARCH LIMITATIONS

The literature regarding a general understanding of children and how they learn is substantial and comprehensive. It is, however, understanding how external influences – especially those unique to the SA context – affect children’s learning, and to what extent, where the literature is incomplete. This echoes the research limitation identified in the previous section of literature, and in this section, it is particularly pertinent with regard to the learning of an additional language. Most findings regarding children learning their home language can – to some extent – be transferred to learners acquiring an additional language, however extrapolation of findings of this nature need to be made with great discretion. For instance, even though learners entering the FP are familiar with their home language and basic literacy skills (such as letter recognition), one must expect that they are entirely unfamiliar with the additional language, and thus not all home language-based study findings are transferrable or pertinent to additional language acquisition. The lack of research on this topic does pose a limitation, and cautions the researcher not to make gratuitous or speculative generalisations.

2.3.6 CONCLUSION

Throughout this section a concise, yet ample, contextualisation of children and their development, and an understanding of how they learn, has been provided. Although this study acknowledges the various theories underpinning additional language learning, it has no intention of aligning with a particular theory, and awareness of these only serves as a way to reframe the researcher’s thinking.

\(^{30}\) It is also worth noting that young children do not mind losing at games, provided they are allowed to have some successes and enjoy themselves (Holt 1983:21). However, as children mature and become more competitive they are likely to become more distressed when they lose.
regarding teaching and learning (MacBlain 2014 ch.1 sect.5; ch.3 sect.2). This study relies predominantly on the DBE sanctioned guidelines regarding additive bilingualism, and further draws on a common understanding of how children learn, to ultimately guide the best approach to supporting additional language acquisition in SA classrooms.

This section has however identified a key aspect that needs to be considered when designing an educational device for children: play is of fundamental importance in a child’s development as it is a crucial element of the learning process. As American author Leo Buscaglia ([sa]) said: “[i]t is paradoxical that many educators and parents still differentiate between a time for learning and a time for play without seeing the vital connection between them”. Children do not necessarily differentiate between play and learning, and thus adults should not try to separate the two. Learning occurs when children are allowed to explore and subsequently understand their environments on their own terms. It is important that this process of discovery is voluntary, and that children are allowed to do so independently. It is also essential that adults recognise that this process of discovery is, in fact, often facilitated through play.

A concern has however also been identified through exploration of the literature in Section 2.3, and comparison with what was reported in Section 2.2, whereby that which is considered ‘best practice’ does not necessarily align with DBE recommendations. This especially holds true with the conflict between the predetermined pace and sequence of work stipulated in the CAPS documentation, and allowing children the opportunity to progress at their own pace. Although not in defence of the DBE stipulations, it must be conceded that the OBE-centralised structure of Curriculum 2005, which specifically allowed individual-paced learning, was a dismal failure.

Children grow physically, cognitively, emotionally, and socially, and the development of all these aspects needs to be supported during the child’s interaction with the proposed design intervention. Furthermore, in current contexts where entertainment tends to be sedentary and screen-based, it is important that children engage in ‘real’, physical play and that they have regular interaction and contact with peers and adults (Fenton cited by MacBlain 2014 ch.5 sect.7). The various facets of learning and child development that have been addressed in this section serve as guidelines to aid the process of determining the type of toy that needs to be designed, and how it can best address the requirements of children in the FP age bracket.

2.4 DESIGN FOR CHILDREN

The third field of discussion for this study is design, and more specifically design for children. It is important to understand the requirements for designing for children, as there are a number of considerations that differ from designing for adults. It is particularly important to recognise that
children are naïve and vulnerable users, and that children differ on a basis of physical development, learning, and communicating. This means that their safety should take precedent over all other design considerations, and that the design of any product needs to accommodate for variance of the aforementioned developmental differences. Furthermore, their learning should not be encouraged at the risk of their safety and development. An understanding of design that focuses on children allows for appropriate guidance to design and develop a product that enhances a child’s development, and that appeals to a child without putting them at risk. Since adults are almost exclusively responsible for the design of products and environments for children, it is their responsibility to understand the specific requirements that need to be addressed in order for children to grow and develop (Corlett 2008:v).

The previous section built a framework within which the understanding of product design for children can be placed. Bearing this in mind, the following section is divided into topics that discuss the physical constraints of product design, product design considerations for children in particular, and specifications for toy design. Section 2.4.1 introduces the anthropometric and ergonomic constraints of product design, whilst bearing children in mind. Building upon this, Section 2.4.2 looks at the more traditional aspects of product design, and how these need to be adapted when designing products for children. Within this section, the suitability of universal design principles is investigated, and a number of child-specific differences that need to be accommodated are discussed. Product safety, which – as mentioned before – is of paramount importance when designing for children, is also discussed in this section. Once a suitable understanding of product design is established, the chapter naturally progresses to a comprehensive overview of toy design specifications (2.4.3). Within this section, age-specific preferences and play behaviour are discussed, as well as considerations for the design of educational toys. This section concludes by ascertaining the relevant research limitations.

As previously mentioned, *Ergonomics for Children: Designing Products and Places for Toddlers to Teens* (2008), edited by Rani Lueder and Valerie Rice, is a seminal work in the field of design for children. It provides a comprehensive guide to ergonomics for children, and aids in the clarification of design considerations and recommendations for products and places designed for children. Throughout their book Lueder and Rice (2008a:3) point out that “children are clearly not ‘little adults’”, and they elaborate on how children’s requirements, problems, needs and desires differ from those of adults, and how these differences account for unique design considerations.

### 2.4.1 Comfort and Fit

As mentioned in the introduction to this section, children cannot be generalised as ‘little adults’, and this is especially important to consider when it comes to the scale and comfort of products that are designed for children. An understanding anthropometrics and ergonomics aids in designing a
product specifically meant for use by children (Lueder & Rice 2008c:256). It is however important to note that even if a product has been designed to accommodate the full range of anthropometric and ergonomic requirements, it is still likely that the product might exclude a certain faction of the population, such people with disabilities. Designers need to find possible ways of including such users in the design of products instead.

2.4.1.1 ANTHROPOMETRICS

Anthropometry refers to the “scientific measurement of sizes, [proportions] and shapes of the human body” (Norris & Smith 2008:39). Anthropometric data is used to design products that are easy to use or control, allow for an adequate range of movement, and do not pose a risk to the intended (or unintended) users (Norris & Smith 2008:39–40). Designers apply this knowledge to their products to ensure suitability for the greatest sample of people, however when designing for children one has to allow for variation in “size, shape, physical and psychological abilities, as well as in personal preferences” (Norris & Smith 2008:52). Designing a product for children requires that the product dimensions accommodate a more extreme range of measurements than would be considered for adults (Norris & Smith 2008:40,52). It is also important to remember that the physical proportions of children are entirely different to those of adults (Norris & Smith 2008:44).

The rapid and inconsistent growth throughout childhood can present difficulties when trying to delimit the anthropometric data necessary for children (Norris & Smith 2008:56). When designing for children, they are typically divided into age groups, however “childhood is a time of continual and rapid change in physical and psychological abilities” and age bands can span only a few years before the changes are too great for children to be comparable (Norris & Smith 2008:41). Due to this, the static anthropometry can vary hugely for children of the same age, and – depending on the product – it can be better to design according to variables other than age, such as stature or weight, or gender-dependent age groups (Norris & Smith 2008:41–42,44). Although the anthropometric data of children can vary based on age and gender, nationality and cultural (or ethnic) differences and also influence this (Norris & Smith 2008:53–54). These differences can be accounted for by factors such as heritage, diet, genetics, and even socio-economic background.

Although standard anthropometric data is a very good resource, it only provides static data, which does not reflect how a product is used ‘in real life’ (Norris & Smith 2008:40). In order to holistically design a product, one needs to consider functional anthropometry, which delimits ranges of movement. However, even when taking movement into account, people (especially children) are prone to using products in non-standard postures, which is something that the designer needs to make allowance for (Norris & Smith 2008:40). Furthermore, problems with anthropometrics come in with regard to clothing or protective wear, and can put restrictions on one’s range of movement, or can alter one’s static anthropometry, both of which can hamper or even prevent the proper use of a
product (Norris & Smith 2008:41). This requires forethought to the usage of the product – for example, when designing an outdoor toy that is used in cold climates, the designer needs to make allowances for the product to be used effectively even when the user is wearing a thick jacket (Norris & Smith 2008:42), or if the user prefers not wearing shoes, or – more likely in the SA context – cannot afford shoes, the designer has to bear in mind the potential lack of protective clothing.

The anthropometric data that is typically available on children tends to relate to height, weight and body mass index (BMI), however a product designer would also require more specific information regarding hand and finger sizes, head diameter, and how wide a child can open his/her mouth (Norris & Smith 2008:47). These anthropometric dimensions need to be considered when looking at the safety aspects of a product. Most products are designed for the majority of the population (typically the 50th percentile), and thus exclude the extremes or outliers, however this should not be done at the expense of safety, and anthropometry needs to be adapted where necessary, or should allow for the full range of dimensions plus a safety margin of quantitative requirements (Norris & Smith 2008:49).

2.4.1.2 ERGONOMICS

Ergonomics is the informed application of anthropometrics to create an efficient design. Ergonomics can be defined as the “applied research discipline concerned with the fit between people, the things they do, the objects they use, and the environments they work, travel, and play in” (Ergonomics Society, cited by Lueder and Rice 2008a:3). Although the physical ‘fit’ does require the application of anthropometric knowledge, when designing for children it is also important that one rounds any sharp edges, refrains from designing openings that could lead to entrapment, pays attention to surface quality and finishes, and plan for “children to use the items in unexpected ways” – all of which aids in the prevention of injuries (Norris & Smith 2008:40). A product that is uncomfortable or dangerous to use is bound to be unsuccessful, regardless of how appealing the aesthetics might be, which is why ergonomics plays an important role in product design.

When designing products or environments it is important to consider children’s vision, which, in turn, affects their posture and comfort (Ankrum & Fostervold 2008:99). Text or visual material needs to be suitably sized and placed at the correct distance and eye-level to ensure that a child can see clearly and that their body is well supported. Children change their posture (deliberately or unintentionally) in order to be able to see, despite any discomfort, and provided children are well supported and their vision is not hindered, they are more productive (Ankrum & Fostervold 2008:100). As much as visual ergonomics need to be considered, so do sound ergonomics. ‘Toxic’ sounds, or excessive noise, can be both distracting and damaging to hearing (Vause 2008:111). Noise can affect a child’s performance, health, ability to communicate, and even their safety (Vause 2008:111). Children are more sensitive to noise, and noise can be particularly detrimental to children
who are learning in a second language or who face other barriers to learning (Vause 2008:112,144–146). When designing environments for children, any potential noise sources need to be identified and the risk needs to be assessed, and when designing products that emit a sound, designers need to ensure that the sound is not unnecessarily distracting, and that it does not damage the child’s hearing (Vause 2008:141).

2.4.2 PRODUCT DESIGN CONSIDERATIONS

When designing a product for children it needs to accomplish several things: the product must be fun, it must build on previously acquired skills, it must challenge children (to develop new skills), it must be universal, and it must be safe to use (Lueder & Rice 2008c:252). Children use whatever skills they have developed thus far to explore new products (such as toys), and although discovering new things is always exciting, the product needs to be both challenging and entertaining in order for a child to remain engaged (Torres 2008:478). When designing any product, the user always needs to be kept in mind, and this is especially important when designing for children, where a product is expected to be user-friendly, safe, functional, fun, and supportive of their growth (Torres 2008:478,496–497). Product design for children needs to find a “balance between safety and stimulation”, where there is consideration for a child’s need to explore and play, their vulnerability, and their physical requirements and limitations (Norris & Smith 2008:57).

Products need to ‘fit’ the children who use them, and child-specific products are not merely scaled-down versions of adult products (Lueder & Rice 2008d:400). Children differ physically, cognitively, and emotionally, and their world perspectives differ, which means that they present unique design opportunities (Lueder & Rice 2008d:400–402). One of the most important considerations is product safety, but some of the other design considerations that need to be taken into account when designing products for children are: the user’s development and specific needs, further growth of the user and how this relates to the product’s life-cycle, comfort and usability, product marketing, and product materials and environmental implications. Over and above these considerations, the product also needs to make allowance for individual preferences, and accommodating the requirements of as many users as is feasible.

2.4.2.1 DEVELOPMENT AND COMFORT

Designing for children requires that designers go beyond accommodating physical growth, and that they focus on ergonomic and user-specific requirements as well. The previous section mentioned a number of ergonomic considerations that contribute to product safety (rounded edges, no entrapment risks, anticipation of unexpected use), and these are further explored in Section 2.4.2.7. Even though most ergonomic considerations are based on anthropometrics and relate to safety, there are additional factors that contribute to the comfort, usability and pleasure of the product. Essentially, products need to be designed to fit the needs of the user, and ‘successful’ products elicit
positive feelings from the user – such as confidence, pride, satisfaction or excitement (Jordan 2000:1; Jordan 1998:25,27–28).

2.4.2.2 FURTHER GROWTH

With regard to physical development, another key difference between designing for children and designing for adults is that adults are designed for as they are ‘now’ (Lueder & Rice 2008d:404). Children need to be designed for as they are ‘now’ and also need to be ‘pulled’ into the next stage of their development – therefore products need to accommodate a child’s current skills level as well as encourage the development of new skills (Lueder & Rice 2008d:404). Due to children’s rapid development (physical, cognitive and emotional) some of the most successful products are those that ‘grow’ with the child; if a product can adjust in size, design or even complexity it can accommodate children at different stages while they grow, thereby extending the life-cycle of the product (Lueder & Rice 2008d:403). This growth needs to be accommodated through consideration of comfort, user preference, productivity, stimulation (or suitable challenge), enjoyment, and safety, for both the current and the future stages of development (Lueder & Rice 2008d:404). Designing products that accommodate for future growth might demand a greater initial cost, but it does increase the life-cycle of the product. This is beneficial to the child (who uses the product longer), the caregiver (who does not need to purchase a replacement as soon) and the environment (since one product can serve a purpose for a number of years).

2.4.2.3 PREFERENCE

Although physical and ergonomic considerations are fundamental, they are relatively easy to accommodate in comparison to personal preferences (Norris & Smith 2008:52). The skills, interests and preferences of children always vary, and as such the stylistic and aesthetic nature of the product needs to be carefully considered (Hanna 2008:755). The two main distinctions in product preference amongst children are age and gender, however preference can also be influenced by culture, family, peers, media exposure, previous experiences, or trends in social predilection (Torres 2008:482).

During the FP, gender-based preferences become more prevalent, and a decision needs to be made regarding the inclusion or exclusion of gender indicators (Hanna 2008:776; Smith 2002:250). Typically, boys display a preference for action-based stories or software, whereas girls prefer animal or human-based content (Smith 2002:272). Gender-neutral designs are not necessarily better, since designs that purport particular interests may be “the most involving and rewarding”, and a gender-neutral product runs the risk of not appealing to either group (Hanna 2008:776). If aiming to design a gender-neutral product, anything apparently masculine or feminine should be avoided, as these

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31 This section deals only with aesthetic differences. Age-based preferences regarding types toys and activities are discussed in 2.4.3.
might discourage a child of the opposite gender from attempting to engage with the product (Hanna 2008:777). Furthermore, colour schemes need to be carefully considered (Smith 2002:272). Ideally, masculine and feminine influences need to be balanced, or they need to include both elements in order for all children to relate to the design (Hanna 2008:777). Alternatively, products can be customised to appeal to either gender, or can be made available in gender-specific variations, although these options do come with higher cost implications, and are not conducive to universal design practise. Negative stereotyping must always be avoided (Hanna 2008:776).

Designing for a broader age group comes with the challenge of appealing to both the younger and the older spectrum, in terms of anthropometrics and preference. For example, if stipulating the size of a building block for children aged between six and nine, anthropometric constraints would require a block that is not too small (thereby not allowing for the limited development of fine motor skills in younger users, or posing a safety risk) and not too big (in order for smaller hands to easily hold and manipulate it), and the consideration of ergonomics and preference needs to allow for a design that is friendly and attractive (to engage young users) and that is simultaneously not juvenile and ‘unsophisticated’ (thereby discouraging engagement from older children). In addition to the aesthetic implications of suitable anthropometric considerations, visual preference needs to be accommodated across both age and gender gaps, for example, as both boys and girls approach the end of the FP, interest shifts from cartoon characters to real-life characters and personalities (Smith 2002:20). Irrespective of visual preference, if the product needs to appeal to a wider age bracket, it likely needs to be adaptable to suit the increasing cognitive challenges that children require as they get older.

2.4.2.4 Target Market

Although the product is primarily designed for the child (the end user), the product also needs to consider the parents (or caregivers) and the teachers, who are likely to assist, supervise or facilitate the use of the product (Gaffney & Hunter 2011). Designers also need to bear in mind that the end user (the child) is not the one purchasing the product (the adult – parent, school or teacher), which means that the product, and subsequent marketing, need to appeal to both the child and the adult (as the child may influence the adult’s decision) (Lueder & Rice 2008d:404). When designing and marketing a product it is important that not only the child’s development and preferences are taken into account, but also the adult’s “knowledge, their own childhood, [and] their concern for the child’s growth and development, as well as for their happiness” (Lueder & Rice 2008d:404). Parents play a significant role in their child’s exposure to play and toys, and this can be affected by parent’s own views and socio-economic backgrounds (Torres 2008:482).
2.4.2.5 USER-CENTRED DESIGN

User-centred design (UCD) refers to a design approach that specifically address the user’s needs, wants and limitations in order to optimise how the user interacts with the product (UCD [sa]). This approach should ensure that the user finds the product “useful and effective” and that the user is able to use the “product as intended … with a minimum effort to learn how to use it” (Abras, Maloney-Krichmar & Jenny Preece 2004:2; Flanagan, Kubie, Melkus & Johnson 1999:463). In order to design a more ‘usable’ product, designers need to consider aspects of usefulness (ability to achieve task), effectiveness (ease of use), learnability (quick competence after instruction) and attitude (likeability) (Rubin cited by Henry & Thorp 2004). Donald Norman, who coined the phrase ‘user-centred design’ in the 1980s, suggests that in order to place the user at the centre of a design, the system, or product, should be easy to predict, responsive, easy to evaluate and “follow natural mappings between intentions and the required actions” (Norman, cited in Abras et al. 2004:2). A successful user-centred design is simple, intuitive, compensates for error and typically avoids unnecessary features and complications (Abras et al. 2004:3).

Figure 4: A typical user-centred design approach.
(User-centred design basics 2017)

UCD, essentially, focuses on the process of designing from the user’s perspective (Rubin cited by Henry & Thorp 2004). This requires cultivating a deep and holistic understanding of the user’s

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32 Whereby ‘usability’ refers to “extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use” (ISO cited by Henry & Thorp 2004)

33 It is acknowledged that not all products can be used or understood without prior initial instruction, but that a usable product lends itself to intuitive use hereafter, and does not warrant repeated instruction.

34 Donald Norman’s book, The design of everyday things (1988), is a seminal work in the field of UCD and, although not directly referenced in this sub-section, it informs the thinking of the researcher’s design process.
characteristics, goals, direct environment, greater context, intended task, and need for a product (Henry & Thorp 2004; User-centred design basics 2017). The UCD approach does not follow an exact method, but it is necessary to involve users throughout the design and development process (User-centred design basics 2017; Henry & Thorp 2004). This being said, a typical UCD approach (see Figure 4) is based on identifying a problem and doing preliminary research (systematic and organised information-gathering with a focus on users and their tasks), which is followed by iterative cycles of analysis, design, and evaluation (testing and feedback), which is eventually followed by implementation and deployment upon finalisation of design (Henry & Thorp 2004; Rubin cited by Henry & Thorp 2004). To elaborate on this, the research step involves specifying the context of use (users, product intent, and environmental variables) and specifying the requirements (determining the goals and design specifications), and the design step can be done in multiple phases, and may require reverting to further research (User-centred design basics 2017).

As mentioned before, the UCD approach necessitates the early involvement of users in the process (Abras et al. 2004:1; Rubin cited by Henry & Thorp 2004), but Abras et al. (2004:5–6) explain that users need not be directly involved in the design process per se, and that their involvement can be limited, for instance, to direct observation, interviews or product testing. With regard to this study, it must be reiterated that even though children might be the primary users of a toy or product that is intended for them, designers have to realise that the use of such products often needs to be introduced, facilitated or overseen by an adult (parent, caregiver or teacher), and as a result, the adult’s needs, wants and limitations should also be considered in the design decision making process.

By applying a UCD approach, designers are forced to think about how their objects are to be used, and with what intention, and what the users’ specific needs, wants and limitations are. It is thus crucial to understand the context within which users, and the proposed product, fall. This factor is of great pertinence to the study, as the SA context is a key factor in framing the problem statement and delimiting the design requirements, and this can be accommodated for through a UCD approach. Furthermore, the research has shown consideration for use from both the teachers’ and learners’ perspectives. UCD has a strong influence on research design and methodology, and it is elaborated upon in this respect in Chapter 3.

2.4.2.6 Universal Design

Universal design, or inclusive design, refers to the “design of products and environments so as many people can use them as possible” (Springer 2008:356). Although this primarily refers to use and function, it can also refer “attractiveness, affordability, and accessibility” (Springer 2008:356). A universally designed product is often easier to use, as it has been designed with consideration for a range of factors, from multiple approaches. For example, if placing a door handle lower on a door, it
can accommodate both taller and shorter children, however if it is placed higher on the door it excludes shorter children. Most products are designed for the majority of the population, and exclude the extremes, alternatively they are designed for specific groups of people, such as people with specific disabilities (Norris & Smith 2008:49). Although this might be appropriate in certain situations, such specific design should not be done at the expense of safety, limited usage, or exclusivity, and anthropometry and other design considerations need to be adapted where necessary in favour of universal design (Norris & Smith 2008:49). The principles of universal design consider equitable, flexible and intuitive use; perceptible information; hazard prevention; and accommodation for use by users with limited abilities (for instance, strength, mobility, or physical development) (Springer 2008:356).

When designing for children it is critical to follow inclusive design practices in order for the product to be appropriate for a broad range of children, and to cater for the large variance in anthropometrics and preferences. This can be done by making certain assumptions based on child psychology and preference. Typical assumptions include: that the users (children) generally have a limited capacity for literacy and numeracy; that children have an aversion to reading superfluous information (Gaffney & Hunter 2011); and that children have a tendency to be clumsy (Smyk 2013). As mentioned before, it is important to remember that there is a great “variance between children of the same age”, and that the end product needs to suitably accommodate such a range (Gaffney & Hunter 2011). This does not only refer to anthropometric or developmental constraints, but can also refer to socio-economic factors. For example, when solutions are designed around the criteria of those who are “hardest to reach” (like the disadvantaged, or the disabled), as opposed to those who are “easiest to reach”, the results are more effective and more extensive, in spite of the additional costs required to do so (UNICEF 2014a).

Universal principles of design (Butler, Holden & Lidwell 2003) deals with various aesthetic and philosophical principles that influence perception, increase appeal and usage, and aid in making better design decisions. Some of the theories that they discuss that are applicable to designing products for children relate to affordances, archetypes, contour bias, depth of processing, flexibility-usability trade-off, Hick’s Law, iconic representation, Ockham’s razor, and the Rosetta stone theory. By incorporating these well-established universal design principles and solutions the “probability that a design will be successful” is increased (Butler, Holden & Lidwell 2003:11). Although the goals of universal design are aesthetic as well as social, one needs to be careful that the minimalist, undistinguished, yet affordable solutions that stem from universal design are not translated into uninspiring and ‘cheap’ excuses for design (Braungart & McDonough 2009:29). Designers need to beware that by ‘designing for everybody’ they might end up designing for nobody; products must not be so indiscriminate that nobody finds them comfortable, or so visually universal that they are too bland to appeal to any demographic (as mentioned with gender-neutral design aesthetics). While
universal design solutions tend to appeal to the largest possible target market due of the ‘worst-case scenario’ design strategy, some might argue that all problems need localised design solutions instead (Braungart & McDonough 2009:29).

2.4.2.7 **PRODUCT SAFETY**

Children are curious, and they are ignorant; and this combination puts them at greater risk than the rest of the population (Lueder & Rice 2008c:321). Children are also more vulnerable, since their coordination is still developing, their reaction times are poor, and their perception of the environment is not always accurate (Lueder & Rice 2008c:321). In order to prevent or reduce injury the following guidelines need to be adhered to: any product or environment needs to be designed to reduce the potential for injury (designer’s responsibility); the child must be supervised (parent’s responsibility); and the child must be warned or educated about any danger that a product might pose (manufacturer’s and parent’s responsibility) (Lueder & Rice 2008c:256). The safety of children’s products and environments are particularly important because any injuries that are sustained might lead to disruption of a child’s development and growth by preventing them from participating in activities, and as a result this might further impact on the development of their social skills (Lueder & Rice 2008c:252).

Exploration of products and environments is necessary for children to develop, and sometimes new discoveries may hurt – this too is part of the learning process (Lueder & Rice 2008c:321). Although all children experience accidents, the injuries that are caused as a consequence of poor product design need to be minimised (Torres 2008:492). When it comes to safety, designing children’s products requires a careful balance, because if the designer eliminates all the risks, they also risk eliminating all the challenges a product might pose, and therefore the product would not contribute to a child’s development (Lueder & Rice 2008c:252). Product safety therefore needs to be balanced with challenge and creativity (Vredenburgh & Zackowitz 2008:910).

**Unintended Use**

Children of all ages seek stimulation from their environment and the products therein – and if the available objects fail to provide the necessary stimulation, children tend to find ways to provide that stimulation themselves (Torres 2008:495). Due to this, children frequently use objects for unintended purposes, which can present inadvertent dangers to the child (Lueder & Rice 2008d:401,403). Designers need to consider both intentional and unintentional use of child-products, and the consequences of both (Torres 2008:495). For foreseeable use, designers can either make a product safe for such use, or prevent such interaction (Torres 2008:495), and for unintentional use, the onus falls on designers to develop an understanding of child behaviour in order to anticipate unforeseen risks (Lueder & Rice 2008d:403).
**Hazard Prevention**

Risks or hazards (referring to “any part of a product or activity that might lead to injury”) need to be identified and then need to follow a hierarchy of either being eliminated, guarded against, or warned against, based on insight of a child’s capabilities and limitations (Kalsher & Wogalter 2008:512). This hierarchy can, to some extent, be enforced through mandatory regulations for toys that aim to minimise injury and fatality. Further elaboration on hazard identification and product safety specifications can be found in Appendix D.

Even though designers, caregivers and manufacturers can implement measures to prevent risks, children seek independence by testing their environment and their skills, and often take unforeseen risks in an attempt to do this since they have not developed the fear that comes with the experience of painful events (Lueder & Rice 2008d:401,402). In addition to this, children have no understanding of their own mortality, and they cannot anticipate the consequences of their actions or interactions with products (Beran & Brown 2008:37; Vredenburgh & Zackowitz 2008:914). When it comes to use of objects that are not intended for children, and since children have a “poor grasp of cause and effect”, adult supervision is essential to ensure the safety of children (Beran & Brown 2008:37). Further elaboration on the importance of adult supervision can also be found in Appendix D.

**2.4.2.8 PRODUCT MATERIALS AND ENVIRONMENTAL IMPLICATIONS**

Designers have an ethical responsibility and it is their obligation to be concerned with the environmental (and social) effects of their work (Whiteley 1993:3). Environmental awareness and the integration of sustainable solutions into products has changed from “being a luxury” and an after-thought to “being a necessity”, and this need not be done at the expense of economic profitability (Fiksel 1996:69). Although choice of product materials is dictated by safety requirements, the context and purpose of the product, and the user considerations, designers should still be urged to make environmentally sustainable decisions. Such decisions should “meet the needs of the present without compromising the ability of future generations to meet their own needs” (the Brundtland Commission (1987), cited by Boradkar 2010:180). If the chosen materials cannot be environmentally sustainable, the design decisions should be made in line with environmental responsibility (such as considerations for recyclability, or optimising a long product life-cycle).

**2.4.3 TOY DESIGN SPECIFICATIONS**

As discussed before, children learn through play, and play is very often associated with either toys or games. Children engage with toys if they are intrigued, and remain engaged as long as they are entertained or having fun (Lueder & Rice 2008c:252; Torres 2008:478). This section briefly discusses the requirements and characteristics that toys need to encompass in order to appeal to the FP age-bracket, as well as the specific kinds of toys and play activities that appeal to learners in this age group. The section concludes with a discussion on specific design considerations for educational
toys, and it is important that all these factors are taken into account alongside the general product design considerations that have already been mentioned.

2.4.3.1 **Typical Toy Characteristics**

A child’s development, abilities and preferences all play a role in encouraging children to interact with toys, for instance, better coordination and fine-motor skills allows for greater manipulation of toys, and allows for the inclusion of smaller and more detailed components (Smith 2002:13). The USCPSC describes 14 toy characteristics that determine the appeal and age appropriateness of toys. These characteristics are: size and shape of parts, number of parts, interlocking versus loose parts, materials, motor skills required, colour and contrast, cause and effect, sensory elements, level of realism or detail, licensing, classic nature, robotic or smart features, and educational consideration (Smith 2002:8–10). The importance of each of these characteristics changes depending on the child’s age and level of development.

A successful toy is heuristic – it enables a child to discover or learn something for themselves. A toy needs to provide young children with opportunities to succeed, and if they fail, they need to be able to turn their failures into successes through practice or perseverance (Lueder & Rice 2008d:402). Leading on from this, as children acquire certain skills, a toy needs to allow children to develop and build on these skills in order to advance developmentally (Torres 2008:479). In general, toys are required to allow for exploration, encourage the use of imagination, “support solitary play as well as play with others”, allow for the expression of emotion and ideas, and “help children develop their own sense of meaning or understanding” (Torres 2008:482).

There are a number of typical toy characteristics that can be borrowed from the design of electronic media content and user interfaces (UI) for children, as these are usually equally pertinent to the design of analogue toys. For example, standard usability criteria should be followed: appropriate and prompt feedback should be given, the language should be understood by the user, the user should be given adequate control, consistent conventions need to be used, user error should be prevented, the user should be granted flexibility, and help should be available when needed (Nielson cited by Hanna 2008:763–764). Design guidelines for 6–8 year old children in particular include: using text sparingly and supporting information or instruction with audio or other sensory cues (their reading skills are still in the early stages, and they tend to ignore instructions in favour of resolving a task on their own); adapting the product to be intuitive (by basing the toy on archetypes or using recognisable contexts); the goals need to be obvious and the challenge should lie in achieving it; and using appropriate motivation (Hanna 2008:761). UI design for children emphasises familiarity, developmental-appropriateness, novelty, and incremental challenges, and toys can easily follow similar criteria (Hanna 2008:779–780).
The content of a UI design needs to be accessible (any metaphors that are used should be based on reality and should be easily recognised, since children’s abstract thinking is still developing), yet challenging, and it is important that at no point the child feels stupid or inadequate – the same goes for the content found in books or the contexts conveyed through games or toys (Hanna 2008:761,763,780). When either electronic media or toys are used for educational purposes, the content needs to be contextually relevant and relatable, novel, and the educational content needs to be closely linked to the story line (Hanna 2008:772). In terms of the visual appearance of the design, aspects such as the font choice and size, colour contrast, and repetition of elements need to be considered (Gaffney & Hunter 2011; Webb 2010). In addition to this, the visual layout – of a UI, graphic elements of a toy, or even instructions – should be clean and logical, and the aesthetic style should be age appropriate (not too sophisticated or juvenile) and take gender differences into account (Hanna 2008:763).

2.4.3.2 Age-specific requirements for successful toys

Toys that are targeted towards FP learners (particularly between the ages of 6–8 years) need to find a balance between their enjoyment of “structured games and skill-based activities” and the pleasure they take in open-ended and creative activities (Hanna 2008:761; Torres 2008:490). Toys that are targeted at this age bracket need to develop children’s gross and fine motor, perceptual, and balance skills, and ideally need to promote friendships or social interactions (Torres 2008:490). FP learners start looking for activities that pose greater challenges for their physical development, problem solving and creativity skills (Smith 2002:20). At this age, children start appreciating and paying attention to realistic detail and working parts, and enjoy using child-sized adult products (Lueder & Rice 2008d:403; Torres 2008:490). They also take enjoyment and pride in using raw materials to create their own products (Smith 2002:20). Popular toy examples include ‘child adapted’ sports equipment, ‘making’ kits (e.g. jewellery), building systems, magic kits, and introductory console and computer games (Torres 2008:490).

Designing a toy that engages children throughout their developmental stages can be difficult, especially as children become more mature (Torres 2008:478). Toys need to present a suitable challenge for a child in order to contribute to their development – if a toy is below a child’s cognitive level the child is likely to become bored as the toy does not provide the appropriate stimulation, and if a toy presents too great a challenge, the product might overwhelm and discourage the child (Lueder & Rice 2008c:252; Torres 2008:482,496). A product needs to fit a child’s abilities, as well as challenge them to improve their abilities (Lueder & Rice 2008c:322). Giving a toy to child younger than the intended age group is inappropriate for both developmental and safety reasons since the child is unlikely to have the skills to interact with a toy in the intended way (Smith 2002:243,259). Linking with the idea of further growth, in order for a toy to be ‘relevant’ as long as possible, the design should consider adaptability based on level of difficulty.
2.4.3.3 Foundation Phase Play Behaviour

The typical play behaviour of FP learners (irrespective of specific toys) revolves around their increasing strength, endurance, eagerness for more challenges, and new-found appreciation of rules (Hanna 2008:761; Smith 2002:19–20). Physical play – particularly outdoors – and manifesting more advanced physical capabilities becomes very important to children (Smith 2002:19). Specific skills development focuses on structured activities that display greater dexterity, such as fast hand games, finger snapping, and braiding, and children enjoy practicing – and even showing off – any newly mastered skills (Hanna 2008:761; Smith 2002:19). Children at this age also start paying more attention to detail, and start using logic to solve particular problems (Smith 2002:20). Typical games include hide-n-seek, cops and robbers, and tag (Smith 2002:20).

2.4.3.4 Toy and Play Preferences

Towards the end of the FP, children become more interested in honing their skills and physical abilities (Torres 2008:491). Child development becomes more uniquely pronounced, as children start expressing their personality traits, and children start thinking more critically and analytically (Torres 2008:491). These developmental characteristics need to be considered when designing suitable toys, and thus collectibles, modelling kits and electronics that can be individually adapted become popular (Torres 2008:491). Of the aforementioned USCPSC ‘play categories’, those that are most susceptible to enjoyment by FP learners are construction play, game and activity play, sports and recreational play, media play, and educational play, and the proposed product should combine the most relevant and appropriate characteristics from these categories (Smith 2002:5).

Construction play (based on building structures using smaller units) begins in early childhood (from the age of 2) and continues into adulthood, with the major changes being the unit size, complexity of built structures, and number of units (Smith 2002:47). Construction play contributes significantly to a child’s development and cognitive competence, as it allows children to “combine visual and motor skills with the ability to plan ahead and execute their ideas through a series of steps” (Smith 2002:47,52). As children enter the FP, their interest in construction play shifts from simple blocks to more complex and interlocking parts, and as children get older their advancing fine-motor skills, coordination, and movement control allow for more complex and detailed constructions (Smith 2002:45,52,61). Towards the end of the FP children have developed the patience and cognitive ability to follow directions, such as those provided in model kits (Smith 2002:63). Block-sets for FP learners typically contain between 80 and 100 various sized and shaped wooden pieces (Smith 2002:52).

As children become more attuned to following instructions, and playing games with rules (from the age of 6), they become more engaged with game and activity play, such as puzzles, board games...
and computer games (Smith 2002:129). Many such games also have educational aspects, which appeals to parents (Smith 2002:129). Puzzles are often considered solitary activities, but they can be used in groups as this encourages a sense of teamwork, especially for children who do not excel at sporting activities (Smith 2002:131). Puzzle-play develops fine-motor skills, visual discrimination, and cognitive problem solving (Smith 2002:131). It also encourages persistence, as it incites repeated failure (placing objects in the wrong place) but with the option of correcting and trying again without being reprimanded or corrected (Smith 2002:131).

Board and card games appeal to young children because they are social in nature, and they allow for interaction with (and opportunities to learn from) adults (Smith 2002:141). Games, by definition, have predetermined rules that stipulate how participants are expected to play, and this aspect becomes particularly appealing to children from the age of 6 (Smith 2002:141). Such games also appeal to parents, as parents have the opportunity to “directly or indirectly teach cognitive and academic skills” (Smith 2002:141). Towards the end of the FP, children have the cognitive ability to understand game techniques and strategies, and their social development means they have a desire to play games with both peers and adults (Smith 2002:143). They can use reading as part of the activity and can remain focused on the game and its rules (Smith 2002:143). Towards the end of the FP, children have a better understanding of abstract concepts and a greater interest in educational and grownup topics (such as trivia, movies, or fashion), which broadens the number of games that appeal to them (Smith 2002:144).

Media play, such as art and crafts, contributes to a child’s holistic development, and remains appealing to both genders throughout the FP (Smith 2002:201). Encouraging creativity develops problem solving skills and instils self-assurance (Smith 2002:201). During the FP, children are most interested in experimenting with art using various materials, and as they mature they pursue a high level of realism and complexity in their creations (Smith 2002:205). Towards the end of the FP, children become even more detail oriented and start mastering their artistic skills (Smith 2002:205–206).

2.4.3.5 Educational Toys

Thus far, general product design and toy design considerations for children have been addressed, however there are a few additional factors that need to be considered when designing toys for educational contexts. Most importantly, designers need to bear in mind that “[d]iscomfort hinders learning”, and that appropriate measures need to be taken to avoid this (Evans et al., cited by (Lueder & Rice 2008b:197). In addition to comfort, both designers and teachers need to remember that even though learning is imperative, children are more prone to learning or engaging in academic activities if they find it enjoyable. It is also important to bear in mind that, as mentioned before, if children are
encouraged to actively engage with the learning process, they are more likely to experience self-motivation and a sense of fulfilment (MacBlain 2014 ch.5 sect.4).

Educational toys are toys that are “designed and marketed specifically for academic gains”, and their appeal and age-appropriateness are determined by the corresponding motor-skills and “level of cognitive ability necessary to engage in [the] intended educational way” (Smith 2002:10,243). Educational toys can encourage the learning of general skills (such as coordination, creativity, problem solving and concentration) as well as intellectual skills (such as reading, writing and numeracy), while simultaneously engaging the child (Rubin et al., cited by Torres 2008:492). Parents usually have a preference to purchase toys that promote broad-based learning, although the effectiveness of such toys remains a concern to some (see 2.5 for further elaboration) (Torres 2008:492). This concern is not unwarranted, as many marketing tactics can over-promise on the benefits of the toys they are promoting. It is, for example, important to note that educational toys do not necessarily trump ‘traditional’, inexpensive toys (such as building blocks, dolls, clay, or crayons) when it comes to learning general skills, such as logic, geometry, coordination, collaboration and social skills (Hirsh-Pasek cited by Moretz 2008; Wilson 2016). Furthermore, skill-specific educational toys can aid the learning of less general skills, such as an additional language, by building on the foundations of ‘traditional’ toys.

When designing educational toys, the learning element needs to be combined with a ‘fun’ element, which is more likely to entice children to want to engage with a product (Lueder & Rice 2008c:252; Torres 2008:492). It is important that even though an educational toy does need to facilitate the learning of a new skill, it still needs to perform the basic function of a ‘toy’ – it needs to allow a child the freedom of using their imagination to explore a product, whilst having fun (Wilson 2016:[sa]). Bearing this in mind, the ‘learning element’ of the toy needs to be immediately apparent, especially to the adult that is making the purchase. Games and products within the learning environment that allow children opportunities to fail, and then rectify that failure allows children to develop “courage and tenacity [that are] necessary for other life events in adulthood” (Lueder & Rice 2008d:402). Furthermore, an educational toy should not be so narrowly focused that it “commands what [the] child does”, instead the child needs to “command what the [toy] does”, and in so doing the toy should enable the child to learn something for him/herself (Hirsh-Pasek cited by Moretz 2008). Toys that are restrictive or narrowly dictate the ways in which they can be used are unlikely to stimulate engagement (Wilson 2016). Instead, educational toys also need to incorporate the development of skills that ‘non-educational’ toys develop, for example, cultivating children’s innate tendency for creative problem-solving (Hirsh-Pasek cited by Moretz 2008).

Educational toys are typically divided into three categories: books, learning toys, and smart toys (Smith 2002:243). Books are the most common educational product that children encounter – both in the home and classroom environments. Reading is a means of developing a child’s language (for
example, it increases vocabulary) and allows for wider exposure to the world than the child’s direct environment (DOE 2003:49; Jackson et al. 2016:13; MacBlain 2014 ch.10 sect.6). Positive attitudes towards reading from an early age encourage positive reading habits, and a child’s success in reading is largely dependent on early exposure to literature and ‘book culture’ (Smith 2002:245). By the time children reach the FP, they should be exhibiting preliminary reading skills, and should be interacting with books independently (Smith 2002:245). As a child’s reading fluency increases, the page numbers, size of books and words, and content should gradually become more complex to reflect this cognitive advancement (Smith 2002:250). Although independent reading should be progressing, FP learners still enjoy being ‘read’ to by an adult (Smith 2002:221,250). Listening to audiobooks or to an adult reading increases a child’s auditory perception and receptivity (Smith 2002:221). Books are an invaluable resource, and the only ‘problem’ that they pose is that they do not present a ‘fun’ element, and that reading tends to be a passive activity that does not necessarily appeal to all children within this age group. Themes that appeal to FP children include magic and fantasy, the world, animals and nature, adventure, and characters they can relate to (Smith 2002:221). During the FP, gender-based preferences regarding content also become more prevalent, as has been mentioned before (Smith 2002:250).

Learning toys are designed for specific uses and to convey particular learning objectives (Smith 2002:259). Such toys are developed with a specific age group in mind and are targeted at certain levels of cognitive participation (Smith 2002:259). Examples of learning toys include magnetic numbers and letters, guessing and memory games, flashcards, playboards, and child-adapted scientific equipment (Smith 2002:243). From the age of 4, children are attracted to toys that relate to various domains of knowledge, such as letters and numbers, colours, shapes, and scientific thought or principles (such as learning about the earth or animals) (Smith 2002:261). FP learners gravitate towards incrementally more complicated learning toys that incorporate a greater sense of realism (Smith 2002:261). Children at this stage have adequately developed problem solving skills and an interest in acquiring new knowledge (Smith 2002:261). As children mature, they have a greater preference for skill-specific toys as opposed to toys that address broad concepts, and any toys that address reading and mathematical concepts are very appropriate (Smith 2002:261).

The last educational toy category is that of ‘smart’ toys, which contain an interactive, electronic or computerised element. Responsive smart toys have encouraged a new kind of play that is based on more creative and intelligent interactions with the user through sound, visual effect, or movement (Smith 2002:269). However, when it comes to smart toys, one needs to be wary of marketing that claims a toy can boost a child’s brain development, as these claims are not always scientifically substantiated (Golinkoff cited by Moretz 2008). Smart toys, like learning toys, have specific

35 As with other high-cost technology, the prevalence of smart toys in underprivileged communities is limited.
intentions, and are only appropriate for children within the target age group (Smith 2002:269). As FP children mature, smart toys should become more intricate and take on a more realistic and detailed aesthetic (Smith 2002:273). Toys or software that include social interaction, elements of popular culture, or competitive sports are appealing to this age group (Smith 2002:273). As with learning toys, smart toys that reinforce literacy or numeracy skills are most appropriate for this age-group (such as simple story-building or problem solving games) (Smith 2002:273).

When designing educational toys, the context in which they are used needs to be considered, since they can be used in either the classroom or home environment, and they can be used in either an individual or group context. Both of these factors have an implication on the cost of the product. If the toy is to be used in a school environment the cost falls upon the school as opposed to the parent, and if the toy is to be used in a group context the unit cost can be somewhat higher, since fewer units would need to be purchased per class. If the toy is developed to be used in a group context it is important to note that younger children need to work in smaller groups in order to remain focused, and to ensure adequate adult supervision (Boucher 2008:245).

2.4.4 RESEARCH LIMITATIONS

The greatest research limitation posed by this topic is finding accurate and current anthropometric data; although there is information available from the USA and UK (largest and heaviest child populations), to Mexico and Japan (shortest and lightest child populations) (Norris & Smith 2008:47), there little information available on the SA child population. This proves problematic, since there is evident inconsistency amongst the measurements of children on a global scale. This study thus relies on international data, and adjustments need to be made towards the lower percentile population in order to accommodate for growth stunting (due to malnutrition, which affects a substantial number of children in the country). One also needs to note that these measurements do not reflect the differences that are present in the multicultural SA community. It is important to be aware of the extent of the racial, ethnic, demographic, and socio-economic variability of the population and how these affect anthropometric data, and to also note that very few studies of anthropometric data consider the measurements of children with physical disabilities or growth restrictions (Norris & Smith 2008:52–54). When using international data – especially if it is not current – one also needs to account for secular (or historical) trends. Globally these have shown that, for children, the ‘bony’ dimensions remain the same, however the ‘fatty’ dimensions (weight and circumferential dimensions) have been increasing over the past decades, which means that children are becoming more endomorphic (Norris & Smith 2008:55–56). Once more the validity of this regarding the SA child population remains questionable.

Furthermore, although there is a considerable amount of literature available that deals with the design of computer-related products and interfaces for children, there is a distinctive absence of
research that addresses guidelines for the design of educational toys, and physical products for children. It is also worthwhile noting that, due to the rapid and inconsistent physical development that children display, there is no systematic guideline that delimits the requirements for children’s products (Hedge & Lueder 2008:722). This poses another research limitation, and as such, a lot of information regarding the design of products for adults needs to be suitably adapted where necessary. These limitations need to be recognised and accounted for during further research and the design process.

2.4.5 CONCLUSION

This section has provided a comprehensive overview of factors that need to be considered when designing products – particularly toys – for children. The design considerations that have been explored in this section form the guiding principles for determining the type of educational toy that needs to be developed as the proposed design intervention, and the physical constraints and characteristics thereof. Even though products do need to accommodate the developmental stage of a child, and they need to provide adequate comfort and stimulation, the design aspect that cannot be compromised on product safety (Routio 2007 ‘Product Safety’). Children are naïve, vulnerable and curious users, and as such their safety needs to be at the forefront of any design considerations. Safety is a necessary characteristic of any toy or product, and the consideration thereof needs to start “at the conceptual stages of product development” (Torres 2008:494). Extensive warning or labelling does not mitigate poor design (Kalsher & Wogalter 2008:518; Torres 2008:495). Designing for children needs to balance their need to explore and play, their vulnerability, and their physical requirements and limitations – designers need to find a “balance between safety and stimulation” (Norris & Smith 2008:57). Furthermore, designing from a user-centred design approach needs to show consideration for the users (both learners and facilitators), tasks (facilitating the learning of literacy, with focus on an additional language) and the environment (classrooms within the SA context).

With regard to toy design in general, it is important to ensure that toys are only components of play, and that they do not dictate the nature of play; instead, toys should stimulate a child’s imagination and allow them to express their creativity (this also relates to principles of user-centred design) (Golinkoff, Hirsh-Pasek cited by Moretz 2008). When it comes to designing educational toys in particular, it is essential that designers build on the skills development of ‘traditional’ toys, and that the product enables a child to learn something for themselves, instead of attempting to introduce an unnecessarily complex approach to learning through play (Hirsh-Pasek cited by Moretz 2008). Furthermore, designers need to be wary of “[underestimating] how quickly a child can absorb ideas”, as the success of a toy is determined by its ‘staying power’ or its ability to keep a child engaged (Hirsh-Pasek cited by Moretz 2008; Wilson 2016). A product needs to ‘fit’ a child’s current abilities, as well as challenge them to improve their abilities through prolonged engagement (Lueder & Rice...
Lastly, as a word of caution, designers need to be wary of designing a toy that teaches a child something that they can learn elsewhere while having more fun in the process, as this eliminates the need for such a toy altogether (Wilson 2016).

2.5 LANGUAGE DEVELOPMENT PRECEDENTS

The final topic of discussion for this study is language development precedents. Presenting a sample of precedents is necessary in order to ratify the realm within which the end product of this study is placed. Investigating existing products aids in the identification of advantages and disadvantages of various designs, and clarifies the scope of products that are already available on the market. It is also important that these precedents are considered within the context of the research parameters that have been set throughout the literature review, namely: FP education, an understanding of children and how they learn, and design requirements for children. The end product of this study is intended to aid the learning of an additional language through creative play, and by looking at examples of good product design of this nature one can create a semblance of what a successful educational resource encompasses, and this assists in informing and clarifying the design direction.

The preceding sections of the literature review have aided in building a framework within which the design intervention is to be used, and with what intentions it is to be designed. In order to provide a comprehensive overview, this section looks at both high-tech and low-tech products, conventional toys, and government interventions. The high-tech precedent section specifically looks at examples of ICT-based learning programmes and ‘smart’ toys, whereas the low-tech section looks at examples of precedents from the following categories: traditional literacy products, word and sentence building products, storytelling resources, and board games. Even though most of the exemplar resources are available locally, none of these have been developed in South Africa, which means that they are not necessarily appropriate for the local context. Hence, both sections also provide insight to the high-tech and low-tech language-based resources that have been developed, or implemented, in South Africa.

In addition to language development precedents, Section 2.5.3 elaborates on the ability and advantages of using conventional toys as language development support resources. When considering a toy that assists a child with learning an additional language, one is prone to assume that this needs to be a technically advanced toy, however language development can be supported with much simpler toys, provided there is adequate adult facilitation. 2.5.3 specifically focuses on the learning opportunities that can be attained through play with wooden building blocks. This section continues by exploring the choice of learning resources that parents and schools are faced with, in terms of their effect on language development, and the influence of the SA context. The final topic in this section examines government interventions that are being implemented in an attempt to
improve literacy and language development in SA schools. More specifically, school-based reading campaigns, the promotion of African languages, and government-sponsored resource development are identified. The investigation of language development precedents is concluded with the identification of any research limitations.

2.5.1 HIGH-TECH LANGUAGE DEVELOPMENT PRECEDENTS

When referring to ‘high-tech’ products, it is generally implied that the product incorporates, or is based upon, a technological aspect\(^{36}\). When referring to toys in particular, the incorporation of technology results in what is called ‘smart’ toys. High-tech products are not necessarily limited to physical products, and can refer to resources that are based on a digital platform, for instance, software that runs on technological products (such as computers or tablets). High-tech products are typically characterised by being electronically powered, having a user interface, and communicating with the user on some level (through visual or audio feedback, such as lights, sounds, or recorded audio). This section discusses two high-tech categories in particular: information and communication technology-based products, and smart toys, and subsequently includes examples of precedents that are developed specifically for the SA context.

2.5.1.1 ICT-BASED LEARNING PROGRAMMES

Information and communication technology (ICTs) refers to technological hardware (for instance desktop computers, and the extensions that are associated with these, such as projectors, or smart screens) that allows access to educational resources that are available digitally. These educational resources are generally available as software programs, but can also be web-based (and accessed on computers), or may be dependent on other dedicated internet-enabled\(^{37}\) hardware devices (such

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\(^{36}\) It needs to be mentioned that the use of technology in both the home and school environment is a matter of contention – although it can be an incredibly powerful tool for learning, it can impair a child’s interactive skills and physical development, and poses its own safety risks (Bennett 2008:574). A major disadvantage that such platforms pose is that they are pre-determined and do not allow for freedom or creativity, and even though some of them incorporate gamification, there is no true opportunity for play. Excessive exposure to tablets, computers or other technologies (such as televisions, cell phones and gaming consoles) can also relate to poor academic performance, change in behaviour, bad posture, or exacerbating sedentary lifestyles (Bennett 2008:576; Hanna 2008:754; Vredenburgh & Zackowitz 2008:909). On the other hand, information and communication technologies (ICTs) in schools can allow children and teachers access to information that is available on the internet, and can provide software programs that aid in learning. ICTs can benefit children’s cognitive development and learning, by allowing greater access to information, developing confidence and self-achievement, promoting independent learning, and providing motivation to learn (Pollock & Straker 2008:789,793).

\(^{37}\) Although the internet is, to a certain extent, irreplaceable – in terms of it being a tool that is a useful source of information, facilitating social interaction and providing a global platform for self-expression – children are nonetheless faced with a number of dangers that are exclusively presented by the internet. Children are typically at risk of exposure to inappropriate content (such as pornography and extreme violence), violation of their privacy, cyber-bullying, and excessive use that could lead to laziness and unhealthy amounts of time spent indoors and in front of a screen (which could lead to health issues such as obesity) (Bellerose, Dawkins, Keltie, Pihl & Third 2014:6,40–41). Access to the internet, and subsequent exposure to the related risks, is on
as tablets designed specifically for children). *Duolingo, Little Pim,* and *MUZZY* are all examples of internet or video based programs that teach an additional language. *Little Pim* and *MUZZY* are specifically targeted at young children, and are sold as DVD-packs with additional books, games and internet platforms. *Duolingo* was originally intended for use by older children and adults, but has subsequently developed a classroom-specific component, called *Duolingo for Schools* which is available for use at no cost.

*Duolingo for Schools* facilitates the learning of reading, writing, listening and speaking an additional language. The platform still allows students access to the normal *Duolingo* ‘curriculum’, but it has been specifically developed with language educators in mind, and provides them with access to an educator’s forum, the option to create and keep track of custom assignments, a variety of classroom activities, and the ability to assess student progress (Duolingo for Schools 2016:3,8). *Duolingo* is founded on the concept of making language education more fun and effective by turning the learning process into a game, as the developers believe that “play…is a great motivator” (see Figure 5) (Duolingo for Schools 2016:4,7). The sessions are delivered in short increments (which accommodates the short attention spans of younger learners) that are personalised depending on the learner’s skill level (Duolingo for Schools 2016:4). The application is built on adaptive learning techniques that allow for incremental learning (Duolingo for Schools 2016:3–4). The *Duolingo* platform also allows for an individually adapted learning process, not only with regard to pace of learning, but also by incorporating a number of different types of motivational features, such as points, leader boards, continuity streaks, and virtual trophies (Duolingo for Schools 2016:5).

![Gamification examples of the Duolingo web-application.](screenshot by author) (Duolingo [sa])

the rise globally, and although children have a right to information, and stimulating content, they also need to be taught how to navigate the internet safely and responsibly (Bellerose *et al.* 2014:32; Georgieva 2014:2).
ICT-based learning programs do have some advantages over analogue methods of teaching children an additional language (see the Duolingo Effectiveness Study by Grego & Vesselinov 2012), as they allow for a greater level of personalisation, individually-attuned incremental learning, responsive feedback, and platforms for teachers or parents to monitor progress. However, these are only effective provided both the child and the teacher are capable of accessing and navigating the technology that is required to use such a program. Although schools are encouraged to make information and communication technologies available in their schools, and to incorporate them into the curriculum, this is not always possible, especially in impoverished communities, due to “financial and personnel constraints”, like strict budgets, limited access to resources (computers, projectors, internet) and insufficient teacher training (Pollock & Straker 2008:798). It is regrettable that the children and situations (like overcrowded classes, or disadvantaged communities) that would benefit most from ICT-based resources are generally incapable of accessing them.

There are also a multitude of applications available for tablets, such as the Apple iPad or the LeapPad Learning Tablets developed by LeapFrog (see Figure 6), that aid in teaching children basic literacy skills. One example of such an application is Rosetta Stone Kids Reading (www.rosettastone.com/kids). Rosetta Stone Kids Reading aims to teach children to become confident and capable readers by teaching core literacy skills through “engaging, self-paced interactive learning experiences personalised for each child” (Rosetta Stone [sa]). The application teaches through game and story-based activities that are facilitated by a range of animated characters. Open-ended applications (for instance, story-building applications) can encourage creativity, however reliance on applications as learning resources runs the risk of “[limiting] a child's learning experience by not engaging all of the senses” (Verenikina cited by Cook 2016).

2.5.1.2 ‘SMART’ TOYS

There is a multitude of ‘smart’ toys available on the market, many of which claim to aid the development of a child’s abilities in mathematics, language, reading, and even programming. Hirsh-Pasek (cited by Moretz 2008) does however warn that such claims tend not to be based on any
scientific evidence, and that parents need to be wary of these products and their claims. The one ‘advantage’ that smart toys do pose, is that they do not necessarily require adult facilitation, which is hugely beneficial in instances where a teacher has to deal with a large group of children and cannot give each child individual attention, or if parents are preoccupied with work or other commitments. However, parents may then fall into the trap of using smart toys as “virtual babysitters” (Verenikina cited by Cook 2016). Smart toys can also aid in the facilitation of additional language development, or verbal communication, if parents are unfamiliar with the additional language. One example of such a ‘smart’ toy is the South Korean developed I-Eng, which is discussed below.

I-Eng (see Figure 7) is a good example of an interactive smart toy that helps children learn a foreign language, however it is targeted at children aged a bit younger than the FP age category. I-Eng consists of a plush toy that interacts with electronically tagged objects, and an accompanying storybook. The plush toy is based on an Arduino board (an open-source electronics platform), and it ‘speaks’ sentences once it senses an interaction with one of the tagged objects. Ideally, interaction with the toy is facilitated by caregivers, as the storybook needs to be read synchronously in order to provide context, and to align with the plush toy’s narrative (Jeong, Lee & Saakes 2016:14). The designers do however claim that ‘free play’ (where children themselves facilitate interaction with the toy and the objects in no set order) prompts “an unscripted narrative… [which results] in natural exposure to the foreign language and a playful ‘learning by doing’ experience” (Jeong et al. 2015a:1,3).

![Figure 7: I-Eng is an interactive toy that helps children learn a foreign language. The plush toy and some of the electronically tagged items are shown above. (Jeong, Lee & Saakes 2015b)](image)

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I-Eng was developed on the basis that children ideally learn a language without much guidance (as with the home language), but that exposure to an additional language is generally limited in households (Jeong et al. 2015a:1–2). Jeong, Lee and Saakes (2015a:2) point out that it is due to this that “[additional] language education is mainly based on external support from teachers and adults capable in the [additional] language”. Jeong et al. (2015a:2) argue that a child’s exposure to an additional language can be increased by including elements of the additional language in the products that typically surround children on a daily basis, such as toys. This also reinforces the use of play in the learning process (Jeong et al. 2015a:2). Jeong et al. (2015a:2) chose ‘free form role play’ as the basis of the interaction activity as this allows for the provision of learning opportunities to children who “may have difficulties in understanding organised games and rules” (Smith, Pellegrini, cited by Jeong et al. 2015a:2).

The designers believe that what sets I-Eng apart from other toys on the market is its ability to respond to a particular situation, instead of reciting words and sentences in a pre-determined or random order (Jeong et al. 2015a:2). However, the current prototype can only detect two objects at a time, which limits the narrative and does not allow for complex gamification, which inevitably leads to continual repetition (Jeong, Lee & Saakes 2016:14). Jeong et al. (2016:14) hope to develop the toy to be available in other languages (as it currently only accommodates for learning English) and to add elements of customisation. They are also considering adding various levels of difficulty (Jeong et al. 2015a:3).

2.5.1.3 South African Precendents

As mentioned in the introduction to this section, the number of SA language development precedents is limited, and this is especially pertinent with regard to high-tech solutions for this age-group. There are, however, three precedents that are readily available: two are examples of ICT-based precedents, and one is an example of a product that can be considered both a ‘smart’ toy and an ICT-based product. The ICT-based resources are the GemIIni Program and Reading Eggs, and both are intended to assist with the acquisition of English literacy skills. It must be noted that both these precedents were, in fact, not originally developed in South Africa, and are concepts that have stemmed from other countries and have merely been adapted to the SA context. The precedent that falls into both high-tech precedent categories is the i-Play Trilingual Laptop by Verimark. This product is designed to resemble a laptop computer, and thereby to introduce children to the functions of a computer – which is the ICT element – however, the computer functionality is limited, it is not internet-enabled, and the product can only be used for the dedicated, pre-loaded games – which ultimately renders this precedent an ICT-inspired ‘smart’ toy.
The **GemIni Program**, which is distributed by Khuluma Education\(^{39}\), is a Discrete Video Modelling (DVM) system that offers a solution to teachers, schools and communities for teaching English as an additional language, primarily in the FP. The video modelling system – which is generally used as a teaching tool for children with special needs – allows learners the opportunity to learn a skill by “watching a video of a model performing a specific skill or demonstrate an example of a concept” (What is Video Modelling? [sa]). The **GemIni Program** offers teachers and parents customisable video-based sessions or classes that facilitate the learning of an additional language, specifically English (GemIni Discrete Video Modelling [sa]). The program teaches basic vocabulary, as well as common phrases, grammar, and subject-specific terminology, and the program also includes content that is specific to the SA context (GemIni Discrete Video Modelling [sa]). The program is internet-based, and even though Khuluma Education promotes it as a low-cost\(^{40}\) teaching tool, they do not take into account access to, nor the cost of, an internet connection and the hardware required to facilitate the watching of the **GemIni Program** sessions\(^{41}\).

**Reading Eggs**, which is locally available through The Click Foundation, is an ICT-based English literacy programme. **Reading Eggs** offers an online phonetics-based programme primarily for FP learners in a formal school environment. This platform allows learners to work at their own pace, and only requires basic adult facilitation, which makes it suitable for teachers who are required to deal with large classes (The Click Foundation 2016). **Reading Eggs** provides visual and auditory instruction – through activities, games and animations – that aims to “assist learners achieve English literacy proficiency at an age appropriate level” (The Click Foundation 2016). The Click Foundation ([sa]) promotes the use of technology, as it is “efficient, cost effective and scalable”, and they propose to make use of “existing unused or underutilised computer labs in schools” in order to enable access to the necessary hardware required to use the **Reading Eggs** platform (The Click Foundation 2016). Through the implementation of **Reading Eggs**, The Click Foundation is also providing job opportunities for unemployed members of the local community to become class facilitators (The Click Foundation 2016). The Click Foundation also provides training for these facilitators and teachers (The Click Foundation 2016). As of 2016 The Click Foundation is providing access to **Reading Eggs** for over 20 000 learners in four provinces across South Africa, and their aim is to reach 50 000 learners by the end of 2017 (The Click Foundation 2016).

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\(^{39}\) Khuluma Education holds exclusive rights in South Africa to the US-based **GemIni DVM** language development program (www.gemiini.org).

\(^{40}\) Both teachers (or schools) as well as students are required to pay a “low-cost monthly subscription” fee (GemIni Discrete Video Modelling [sa]).

\(^{41}\) According to the World Economic Forum’s **Global Competitiveness Report for 2016/2017** South Africa ranks as 111\(^{th}\) out of 138 countries with regard to internet access in schools, which means there is still vast room for improvement, and relying on a stable internet connection is not without risks (Schwab 2016:325).
The *i-Play Trilingual Laptop*[^42] (see Figure 8), developed and marketed by Verimark, is one of the only locally-developed language-based ‘smart’ toys on the market (available for R549.00). The *i-Play Trilingual Laptop* features 40 educational games that can be played in English, Afrikaans or Zulu. There is a focus on learning an additional language through switching the chosen interface language, however it appears as though the product only facilitates the playing of the various games in the chosen language, as opposed to truly teaching the language. The difficulty level of the games can be adapted according to the child’s age and ability, and the games are geared towards improving “spelling, language, common sense and mathematics” (Verimark [sa]).

![Figure 8: The *i-Play Trilingual Laptop* has been developed specifically for the SA market, but its ability to teach an additional language remains questionable.](Verimark [sa])

### 2.5.2 LOW-TECH LANGUAGE DEVELOPMENT PRECEDENTS

Contrary to high-tech products, low-tech products are not reliant on any technological components. This means that they typically do not ‘communicate’ with the user, they are not reliant on a power source, and they are not restricted by a predetermined narrative. Low-tech products are often cheaper to manufacture, do not require continuous maintenance, and are not prone to failure, as their high-tech counterparts are. Verenikina (cited by Cook 2016) believes that ‘traditional’ or low-tech toys allow children the opportunity to be creators, as opposed to high-tech toys, which merely turn children into passive consumers. Where electronic toys follow a predetermined set of instructions, traditional toys allow children the freedom to engage creatively. This section discusses four different low-tech product categories: precedents that have long been associated with literacy development, word and sentence building products, storytelling resources, and board games. As in

[^42]: Also available is the *i-Play Bilingual Laptop* which features an English / Afrikaans interface (available for R449.00).
the previous section, examples of language development precedents that have been developed for, and within, the SA context are also discussed.

### 2.5.2.1 Traditional Literacy Products

There are a number of products that are ‘traditionally’ associated with language development, for example magnetic letter sets and flash cards. Magnetic letter sets primarily focus on letter, and even colour, identification, but apart from word building these offer very little in terms of versatility (Yeh 2012b). Since they typically do not come with guidelines, the use of magnetic letters in language development is reliant on the adult facilitator’s initiative. Even so, children enjoy playing with and arranging these, and greater exposure to letters encourages literacy development in the long run, and may encourage a child to practice spelling on their own (Yeh 2012b). Flash cards are another example of a traditional language development tool. Alphabet flash cards typically depict lower and upper case letters, as well as a corresponding image and word (see example in Figure 9). Bilingual variations of flash cards are also available. Although flash cards are a commonly used resource, they are not particularly engaging. Furthermore, they do not capitalise on the ‘play’ element of the learning process, they are reliant on repetition, and they do not allow for incremental learning, all of which limit their ability to encourage language development – in both the home language and an additional language. Even though these traditional literacy products do deserve some merit regarding their influence on language development, the success of the isolated or long term usage of these products as language development resources remains questionable.

![Figure 9: An example of an alphabet flash card set. (Alphabet Phonics Cards [sa])](image)

### 2.5.2.2 Word and Sentence Building Products

Apart from the aforementioned customary products that are used for language development, word and sentence building tools are the most discernible resources available to do so. This section
discusses three precedents that allow for scaffolding, by providing incrementally more challenging activities, and where learners can build upon the knowledge gained from interacting with the preceding, simpler product. The Word Construction toy (see Figure 10) by Learning Resources is an example of an analogue toy that supports literacy acquisition and simultaneously allows for the development of gross motor skills. The ‘nuts’ need to be put onto the ‘bolt’ in a consonant, vowel, consonant order, and then the nuts can be turned to create new words (Word Construction [sa]). The bolt can accommodate up to four nuts, which allows children to make new and longer words, as their abilities progress. The set comes with six bolts and 30 nuts, which allows for a variety of letter combinations, and allows multiple children to play at a time (Word Construction [sa]). This toy can also be used to make words in different languages, provided the language uses a standard Latin alphabet.

Figure 10: Word Construction is an example of a low-tech toy that aids in literacy acquisition and gross motor skills development at the pre-primary and early FP level. (Word Construction [sa])

For learners who have progressed from the nuts-and-bolts Word Construction toy, Learning Resources provides a more challenging product called the Reading Rods: Word Building Kit (see Figure 11). This kit allows children to build words and practice their spelling by linking together four-sided colour-coded rods, as per the provided activity cards. This toy is a progression from the Word Construction toy as it incorporates silent e’s, consonant blends, digraphs, diphthongs, and advanced vowel combinations (Reading Rods Word Building Kit [sa]). This toy also focuses on the development of fine motor skills as opposed to gross motor skills, as the blocks are smaller and the

43 Learning Resources is a USA-based company that manufactures and sells “innovative, hands-on educational products” for children from pre-school to early Intermediate Phase (Learning Resources [sa]). The company aims to provide unique educational resources that “enhance instruction and provide engaging learning experiences that meet children's individual needs” (Learning Resources [sa]). Learning Resources provides a range of products that aim to develop foundational skills “through exploration, imagination and fun” (Learning Resources [sa]).
construction method more refined. The set comes with four activity trays, allowing up to four students to work individually on word-building. Unlike the Word Construction toy, the Reading Rods: Word Building Kit unfortunately does not allow for adaptation to other languages, as the activity cards are presented in English, and the letter combinations are exclusively conducive to English linguistics.

![image of child using Reading Rods](image)

**Figure 11:** The Reading Rods: Word Building Kit presents FP learners with more advanced words, but allows them to draw on the knowledge gleaned from interaction with the previous example.

(Reading Rods Word Building Kit [sa])

The Reading Rods: Word Building Kit advances to the Reading Rods: Sentence Building Kit (see Figure 12), which allows for the construction of longer rods by building sentences with colour-coded links. This allows children to further develop their literacy skills, by practicing grammar and sentence construction. The colour coding of words is divided into nouns, adjectives, adverbs, verbs, pronouns, conjunctions, articles, interjections and punctuation (Reading Rods Word Building Kit [sa]). As with the previous example, this kit contains activity and demonstration cards, and only four activity trays. The Reading Rods series also includes a phonemic awareness kit, a simple sentences kit, and word-building game\(^ {44}\) (which is limited to two to four players). As previously mentioned, the Reading Rods series is limited to use in English, however the entire series is available in Spanish, and also includes a set with only individual letters and pictures which can be used to build a child’s basic vocabulary in Spanish as an additional-language learner.

\(^ {44}\) The word-building game is available locally, and retails for R680.00.
2.5.2.3 STORYTELLING RESOURCES

Adam Beck (2013c), author of *Maximise Your Child’s Bilingual Ability: Ideas and Inspiration for Even Greater Success and Joy Raising Bilingual Kids*, emphasises the importance of stories and storytelling in a child’s linguistic and cognitive development, especially with regard to bilingualism. Even though stories are available as TV programs and movies – as well as books – exposing a child to different kinds of storytelling and verbal engagement enriches the child’s experience of both the home and additional language (Beck 2013c).

Storytelling from a child’s perspective is twofold: listening and telling. Some ways to expose a child to listening to stories include the adult engaging in conversation by telling fictional ‘made-up’ stories, reading stories aloud, listening to audio recordings of stories, or encouraging ‘captive reading’ (Beck 2013c). Whereas listening to stories tends to be a predominantly passive activity for the child, storytelling tends to be more engaging. As with listening, children can be encouraged to read stories aloud, or to tell their own ‘made-up’ stories, but some children may find this more challenging in a language with which they are not familiar, and may benefit from support resources. Most storytelling resources depict only images, which means that the resources can be used in any language (Beck 2013b), provided the images are contextually and culturally relevant or recognisable. This also means that the same resource can be used for younger learners in their home language, and for older learners in an additional language. In addition to developing language skills, storytelling resources also stimulate creative thinking. Some examples of storytelling resources are *Tell Tale* (see Figure 13) and *Rory’s Story Cubes* (see Figure 14), both which require the building of a narrative based on randomly provided images. *Tell Tale* uses double sided cards portraying full colour images (120 images in total), and *Rory’s Story Cubes* relies on nine dice which depict simple monochromatic icons (54 images in total). Beck (2013c) reports that *Tell Tale* tends to be more successful with engaging younger learners, since more images are provided, and the images are more visually stimulating, however *Rory’s Story Cubes* are less age-specific and pose a greater challenge, as the simplistic nature of the icons leaves much open to interpretation by the individual.
Rory O’Connor originally developed Rory’s Story Cubes (see Figure 14) as a visual tool to assist adults with creative problem solving (Our Story [sa]). The concept originally resembled a Rubik’s Cube and was intended to assist therapists and creative trainers, however the concept was reinvented as a collection of dice in response to the unintentional applications the product was being used for (such as facilitating creative writing classes, and family entertainment) (Our story [sa]). The dice format allowed for a better ‘game’ aspect, as it allowed for more, unique combinations, however this new format also allowed for the retention of the portability aspect, which was very popular (Our Story [sa]).

Even though the product started with the original nine-dice system, there are variations to the original (following an ‘Action’ and ‘Voyages’ theme), and three-dice expansion packs are also available (these are centred around specific topics, such as ‘Enchanted’, ‘Prehistoria’, and ‘Medic’). The product is also available in nine-dice themed sets, such as ‘Batman’ and ‘Looney Tunes’. A MAX range (see Figure 15) is also available, and features larger dice that are more appropriate for bigger
groups, or classrooms. Even though the larger size hampers portability, the MAX range makes the product available to people with limited motor skills, or with reduced vision, and it decreases the risk of choking with young children (Rory’s Story Cubes: MAX [sa]). The Rory’s Story Cubes range promotes its ability to encourage creative thinking, develop confidence, enhance literacy and language development, and encourage sociability (Rory’s Story Cubes [sa]). The product is often used by Teaching English Foreign Language (TEFL) teachers and other educators, to promote language skills and creativity, but it is not limited to use by children and can be used amongst adults as an ice breaker, idea generation aid, and by parents to create unique bedtime stories (Rory’s Story Cubes [sa]).

The Story Starter Picture Cubes (see Figure 16) set is similar to Rory’s Story Cubes, but more suitable to a younger audience, as there are fewer cubes, the cubes are bigger, and they are made from foam. These soft foam cubes are colour coded (blue for characters, orange for setting, and green for situation), and allow for incremental learning, as children have the opportunity to add more elements to the story as their language and cognitive skills advance (Soft Foam Story Starter Picture Cubes [sa]). Unlike Rory's Story Cubes, which is marketed as a creative thinking tool across all age groups, Story Starter Picture Cubes is specifically aimed at younger learners to allow for the development of verbal language skills, prior to the understanding of written language. This precedent could however also be used to teach an additional language to older learners who do have more advanced literacy skills, but still enjoy storytelling and who do not necessarily have the confidence to read additional language material. This toy also allows for the development of social skills, as children are required to listen to others, and to allow others the chance to tell their own stories (Soft Foam Story Starter Picture Cubes [sa]).
Figure 16: The *Story Starter Picture Cubes* allow for verbal language development prior to the understanding of written language. (Soft Foam Story Starter Picture Cubes [sa])

Alternative variations are also available, such as *Conversation Cubes* (see Figure 17), which does not focus on storytelling, but sparks discussions between children and adults, or amongst peers, in an attempt to encourage children to talk and to develop their oral language, social, and listening skills (Conversation Cubes [sa]). The foam block-set features 36 questions that are relevant to learner experiences and perspectives (Conversation Cubes [sa]). *Conversation Cubes* in particular, is focused on English, and as the questions are depicted in English this resource is not appropriate for use in an alternate language. Also available in this range are: *Retell a Story Cubes, Phonics Cubes, Word Family Cubes, Reading Comprehension Cubes*, and *Writing Prompt Cubes* – each of which allows for incremental learning opportunities. With the exception of *Word Family Cubes* (which retails for R155.00), all products in this range retail locally for R275.00. The *Phonics Cubes* range is also available in a classroom set, which comes with 18 letter-depicting foam blocks (available for R660.00).

Figure 17: Since the questions on *Conversation Cubes* are depicted in English, this precedent is limited with regard to its versatility. (Conversation Cubes [sa])
The storytelling resources that depict images are no doubt the most versatile, as they can be used in any language, and – depending on the design of the resource – they are not necessarily limited to a specific age-bracket. Storytelling as an educational tool presents benefits regarding both language development and creative thinking, however storytelling does provide one significant hurdle. This being, that if a child is to listen to an adult tell a story in an additional language, the adult needs to be competent in that language. The same applies when a child tells a story in an additional language; it can only be encouraged provided the adult facilitator is fluent in the additional language. This reiterates what Jeong et al. (2015a:2) identify regarding additional language education being predominantly “based on external support from teachers and adults capable in the [additional] language”.

2.5.2.4 Board Games

There is an extensive variety of word, letter and spelling board games available on the market, and although these are generally bought with the intention of using them in the native language, these games do offer versatility as they can be adapted for use in an additional language (with the exception of unique letters and diaereses), and thereby develop literacy skills in the additional language. Beck (2013b) suggests that when young children participate in such games, the rules should be modified to make the games more child-friendly, for example, omitting or adjusting time restrictions, adapting scoring, or turning the games into cooperative instead of competitive endeavours. With word-based board games it is also important to emphasise that spelling errors are not unwelcome, and any mistakes should be seen as learning opportunities (Newman [sa]). As children become older and improve their abilities, the rules can be suitably adapted to continuously provide new challenges.

This being said, there are also many games that have been adapted for younger players, or that are available in different languages. Scrabble (see Figure 18), for example, is available in 29 languages, is available in a child-friendly version called Junior Scrabble, and has released a variation called Upwords (see Figure 19), which allows players to modify existing words by placing letter tiles on top of each other (Scrabble 2016; Beck 2013b)). Many of these traditional board games are now also available as digital versions, but Beck (2013b) warns that the limited social interaction of the digital versions is problematic, as this reduces the richness of the game-experience. In addition to this, Beck (2013b) suspects that the hands-on nature of board game-play does “more to stimulate a child’s brain than clicking a mouse or pressing a button”.

Figure 18: Scrabble, the tile-based word building game – invented by an American architect in 1983 – remains popular today, and is available in many languages and variations. (Scrabble 2016)

Figure 19: Upwords is a variation of Scrabble which allows players to modify existing words by placing letter tiles on top of each other. (Beck 2013b)

As with Scrabble, Boggle (see Figure 20) is another board game that has potential for adaption to different languages. If Scrabble is comparable to a cross-word, Boggle can be likened to a word search; but it is not limited to linear or unidirectional movement and it progresses much faster than Scrabble due to the three-minute per round time limit (Beck 2013b; Newman [sa]). Due to this, Boggle is particularly effective at developing language and vocabulary skills in environments that are time sensitive, such as therapy sessions, or classroom lessons (Newman [sa]). In addition to general literacy skills, Boggle also helps children develop word recognition, improves spelling, and develops “thinking skills and visuospatial skills as players rapidly sift through a pile of jumbled letters to form words” (Newman [sa]). As mentioned before, the rules should be adjusted to be suitable for younger participants until they are more mature, or capable of participating in a competitive or time-restricted version of the game.
Due to the game-play of Boggle, it is suitable for use in time-restricted situations like therapy sessions or classes. (Beck 2013b:[sa])

Bananagrams (see Figure 21) is a similar concept to Scrabble, but is not limited by the size of the board, it has a less complex scoring system, and it allows players to participate simultaneously (in small groups) instead of awaiting turns, thereby making it more engaging. Bananagrams is a fast-paced game that requires players to build a grid of words using all the available letter-tiles. Beck (2013a) suggests a less competitive and more child-friendly version that requires a child or group of children to work cooperatively to make a single, big crossword using all the tiles. This version develops social skills alongside literacy skills. Bananagrams is a beneficial resource, since it elevates concentration, it develops cognitive skills, it encourages literacy, it remains engaging as it is not repetitive, and it has the potential to spark long term interest in word games that is beneficial for future literacy skills (Beck 2013a).

As mentioned before, the number of locally-developed language-based precedents is rather limited. It must be noted that even though suitable Learning and Teaching Support Materials (LTSMs) (such as books and posters, which are by nature ‘low-tech’, but lack an element of play or ‘fun’) are widely
available in all official languages to support the development of the home language, the precedents that are required for this research study are products, toys, or games that facilitate the acquisition of an additional language. There are currently two local brands which develop products that suit these criteria, and that are focusing their resource development on products that facilitate the learning of an additional language – that is not limited to English – within the SA context.

The first brand is *African Voice* (exclusive to online retailer Learning Tools45), and their product range specifically focuses on the necessities of being suitable within a SA context. The *African Voice* products facilitate the bi-directional learning of four languages (Afrikaans, English, isiXhosa and isiZulu), and are developed on the basis that additional language acquisition is more successful if children build a comprehensive vocabulary prior to learning grammar and sentence structure (Learning Tools 2015; Viva Vocab Game for Second Language Acquisition [sa]). The *African Voice* resources also rely on the aforementioned fact that the same product “can be used for the younger children (aged 5–7) in [their home language], and then [for] the older learners (aged 9–12) in the second language” (African Voice [sa]). The two *African Voice* products that are discussed as precedents are *Conversation Station* (see Figure 22) and *Viva Vocab* (see Figure 23).

*Conversation Station* (available for R300.00) (see Figure 22) is promoted as a “resource [that] uses critical thinking questions to stimulate thinking, interest and conversation in the learners” (Conversation Station Second Language Acquisition Game [sa]). The game contains 40 double sided cards – the one side depicts “a truly South African photo” and the reverse poses critical thinking questions46 and relevant vocabulary47 that relate to the image (Learning Tools 2015). The questions and vocabulary are presented in English, Afrikaans, Xhosa and Zulu. As mentioned before, this resource can be used to strengthen verbal literacy in the home language for younger learners (Grade 1), and can also be used to support the acquisition of an additional language in older learners (Conversation Station Second Language Acquisition Game [sa]). *Conversation Station* works as follows: the adult facilitator holds up the image for the child/children to see and then asks the critical question in the relevant language. Younger children can provide answers in their home language, and older learners can answer in the additional language. The facilitator can then reinforce the relevant vocabulary (as it appears on the card) with reference to the image.

45 Learning Tools (www.learningtools.co.za) is a SA online retailer that was founded by a qualified FP teacher. The company sells both local and imported educational resources for developing literacy, numeracy, science, and social skills (About Learning Tools [sa]). The company focuses on selling products that are “visually appealing, stimulating, engaging and create a non-threatening learning environment” (About Learning Tools [sa]).

46 Critical thinking questions are not designed with ‘right’ or ‘wrong’ answers; they are intended to be open to interpretation and are intended to develop *how* children think, as opposed to *what* they think (Learning Tools 2015).

47 The vocabulary words are listed in the CAPS top 200 vocabulary list (Conversation Station Second Language Acquisition Game [sa]; Learning Tools 2015).
Figure 22: *Conversation Station* is a locally developed game that supports the acquisition of an additional language, as well as critical thinking skills. *(Conversation Station Second Language Acquisition Game [sa])*

*Viva Vocab* (available for R350.00) is a flash card-based language-system (see Figure 23). One side of the card depicts an image, and the other side shows the corresponding word (and syllabic transcription) in English, Afrikaans, Xhosa and Zulu. The set consists of 250 vocabulary words, all of which appear on the CAPS vocabulary lists *(Learning Tools 2015)*. The words are colour-coded according to the category in which they fall (for example: numbers, days of the week, emotions, verbs, nouns, adjectives etc.) *(Viva Vocab Game For Second Language Acquisition [sa]).* Although suitable to the SA context, and supportive of vocabulary building in both the home and additional languages, the aforementioned disadvantages of flash cards persist with this product (namely the lack of learner engagement and ‘play’ element, reliance on repetition, and limited opportunity for incremental learning).

Figure 23: The *Viva Vocab* flash card system is the second *African Voice* product that is aimed at supporting the teaching of an additional language. *(Viva Vocab Game For Second Language Acquisition [sa])*

*PUO* is the second SA-based company that develops bi-lingual resources aimed at teaching children (especially at the pre-primary and FP level) an additional language, with particular emphasis on the development of indigenous languages alongside English *(PUO Products [sa]).* The *PUO* resources (particularly their bilingual books) are available in English and isiZulu, isi Xhosa, Sesotho or Afrikaans. *PUO* states that their product range “educates, entertains and empowers children through Africa’s heritage” *(PUO Products [sa]).* *PUO* has a range of bilingual books, flashcards and posters.
available that have been developed alongside teachers, and have been approved by the DBE. These products do fall under the more traditional ‘academic’ LTSMs, and their range of resources does not include a game or toy that can be used to aid with language acquisition, but the PUO products’ African-language based bilingual aspect sets them apart from other products on the market.

2.5.3 CONVENTIONAL TOYS THAT AID WITH LANGUAGE DEVELOPMENT

The toys that are most beneficial for language and speech development are those that allow for “language rich play in meaningful context” (Two-daloo 2014). Due to this, many paediatric speech-language pathologists, as well as educational and child psychologists, do not believe that electronic or ‘smart’ toys (see Figure 24 for an example) are better suited for the development of language skills. Many therapists therefore prefer to use simpler, or more conventional ‘low-tech’ toys – that are not necessarily marketed as being educational – to stimulate language learning (for both home and additional languages). It is important that toys encourage children to not only memorise and recite words, but to use them functionally (not just to label objects) (Two-daloo 2014), which means that the toys have to be contextually relevant and that they need to allow for creative freedom. A University of Delaware and Temple University study found that, despite the overwhelming supply of digital and smart toys, learner interaction with ‘real’, physical toys should not be underestimated, as these are crucial to developing a holistic understanding of the world (Fenton cited by MacBlain 2014 ch.5 sect.7; Norton 2013).

There are a number of toys that have not been specifically designed to facilitate the learning of an additional language, but that can nonetheless help with the development of language and literacy skills. Examples of such toys include marble race games, building blocks, shape sorters, toy

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telephones, play-sets (farm sets, kitchen sets, doll houses), balls, and sensory tables, to name a few (Two-daloo 2014; Yeh 2012a). A marble race game, for instance, can aid with vocabulary building, following instructions, coordination, fine motor skills development and problem solving, and yet it still allows for creativity and incremental learning, as it can be constructed in an endless number of configurations (Yeh 2012a). In order for a toy to facilitate this kind of learning, a meaningful context needs to be provided, yet the narrative should not be set, thereby allowing the play interaction to be open-ended (as with play sets or building sets) (Two-daloo 2014). In addition to this, the toy should encourage reciprocal social interaction and allow for versatility (Two-daloo 2014). These ‘simple’ toys also allow for pretend play, since they are not bound by any instructions. Even though these toys tend to be aimed at language development in younger learners (pre-primary age) who are still learning their home language, they can be adapted to facilitate the literacy development of an additional language in older learners (FP age). This is particularly pertinent to the SA context, since FP learners are not expected to be familiar with an additional language when they enter formal schooling, and their exposure to the additional language is likely minimal.

Simple wooden building blocks have received significant attention regarding their capacity to support language development. Erickson (cited by Westervelt 2015) advises that the importance and power of the humble wooden block should not be discredited on the basis of its lack of complexity. Building blocks (and other construction toys) allow for pretend play, creative problem solving, and social interaction (Two-daloo 2014). Cooperative building activities allow children the opportunity to develop better social skills, such as compromising, collaborating, negotiating and sharing (Dewar 2015b; Westervelt 2015). They also facilitate the development of basic skills, such as spatial awareness, coordination, balance, motor skills, and language skills (Dewar 2015b; Westervelt 2015). Block-play is often associated with the development of mathematics skills, and studies show a direct relationship between block play and higher achievement in mathematics, however, block play also allows for the development of skills that aid in language development, such as “[recognising] cause-and-effect sequences” (Dewar 2015b). The language development aspect of building blocks is very closely linked with the social element that accompanies construction play. This is due to the fact that social engagement, with both peers and adults, allows for verbal communication which inevitably supports the development of language skills (Christakis cited by Westervelt 2015). Block-play is thus particularly beneficial to children if the play is facilitated by an adult, as this contributes to the improvement of spoken language capabilities, and allows children to learn from examples (Dewar 2015b).

In 1913, educator Caroline Pratt designed and introduced ‘unit blocks’ (see Figure 25) as part of the curriculum at her City and Country School in New York City (Westervelt 2015). Pratt believed that children would interact with these building blocks without guidance or pre-determined narratives, and that children would adapt the blocks according to their own interests, skill levels and contexts. Pratt
(cited by Westervelt 2015) believed that this ‘free play’ would be the driver of learning. The City and Country School still offers a Blocks Program as part of their curriculum, since building blocks allow “multiple and diverse opportunities [for children] to express their understanding of the social and physical world in which they live” (City and Country School [sa]). In early childhood, children use blocks for experimentation and discovery play, and when they reach the FP, blocks are used to facilitate cooperation and empathy activities, and to continuously hone their creativity (City and Country School [sa]). The school believes that this free play with blocks throughout the school curriculum allows for “the development of academic skills, collaborative problem-solving, vivid narratives and powerful imaginative thinking” (City and Country School [sa]). The school also introduces structured block play (for example, recreating an existing structure) for older children as it aids with critical analysis and problem solving (Dewar 2015b; City and Country School [sa]).

![Figure 25: Examples of ‘unit blocks’ that were developed by Caroline Pratt in 1913, and are still used in classrooms globally.](City and Country School [sa])

Two contradicting arguments are presented when it comes to the design of building blocks themselves. The first argument suggests that language skills are better developed through block play if the blocks are left ‘naked’, as this allows for greater freedom of the imagination, since the blocks do not force a predetermined and potentially limiting context upon the child (Two-daloo 2014). Pratt’s ‘unit blocks’ align with this reasoning. The second argument contradicts this, and recommends that children should be provided with suitable contexts (e.g. printed graphics) or

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49 It is important to note that construction play is not limited to a certain age category, and that children, adolescents, and even adults, enjoy participating in various forms of construction play (Dewar 2015b). A good example is LEGO, which provides age-appropriate building sets, all of which use the same building blocks but focus on engaging different age and target groups. Even adults continue to use more challenging forms of construction ‘play’ to practice skills and test concepts (Dewar 2015b).
accessories (such as characters), as this stimulates pretend play (Dewar 2015b). Some traditional building block sets, for example, feature educational themes (see Figure 26). The *Bugs Alphabet Blocks* set (Figure 26, left-hand side) features illustrations and names of insects and beetles one side of each block, and a combination of upper and lowercase letters, and entomology-themed patterns on the remaining faces. The *German Alphabet Blocks* (Figure 26, right-hand side) feature uppercase letters, numerals (with the corresponding number written in German), mathematical symbols, and animal illustrations (with their corresponding names in German). The *German Alphabet Blocks* can be used to introduce German as an additional language to young learners, while also engaging in counting, stacking, building, and sorting activities (German Alphabet Blocks [sa]). In addition to the aforementioned skills that are developed through block play, these examples add an educational element, which might appeal to parents, and might spark interest in a new topic for the learner, but this does run the risk of curbing imaginative play.

![Figure 26: Two examples of building block sets that have been designed to include an educational element. The *Bugs Alphabet Blocks* (left) feature an entomological theme, and the *German Alphabet Blocks* (right) depict letters that are unique to the German language and illustrations that are labelled in German. (Bugs Alphabet Blocks [sa]; German Alphabet Blocks [sa])](image)

Even though a number of studies have shown that children who regularly interact with blocks through play “have better language and cognition skills than control groups” (Westervelt 2015), building blocks also have their limitations with regard to additional language skills development. The same can also be said for the other traditional toys that have been mentioned. The biggest obstacle lies in the verbal communication that is required from an adult facilitator. Language development is not guaranteed unless conversation is actively instigated or encouraged. The conversation that is facilitated also needs to be in the additional language, and the learner needs to be discouraged from reverting to the home language. Another hurdle lies in the fact that even though many of these toys might be beneficial for use in one-on-one therapy sessions, their success within a classroom environment is not necessarily guaranteed, as they require a lot of individual attention and verbal facilitation from the teacher. Furthermore, some of these toys can only be used by an individual, and although some examples (for example, toy telephones) allow for teaching social skills like sharing,
they are not conducive for use in larger groups. Building blocks, on the other hand, are favourable for group-play, but language development on an individual level may once again prove demanding.

2.5.4 ON THE USE OF LANGUAGE LEARNING RESOURCES

Even though general guidelines for educational toys have been discussed in previous sections, it is important to note that additional language development can be supported in the same ways – and with the same toys – that are used to support home language development (Korngold 2015). However, mere exposure to learning resources does not encourage language development, and use of the additional language in particular needs to be encouraged and exemplified in the home, in school, and in other social interactions (Ford cited by Korngold 2015). Furthermore, assistive devices are meant to ‘assist’ and cannot replace “intentional, well-designed and [well] implemented instruction” (National Centre for Learning Disabilities 2010). The accessibility of electronic media has no doubt provided significant competition for traditional toys and physical play as a leisurely pastime, as well as an alternative means of teaching (MacBlain 2014 ch.3 sect.5; Vredenburgh & Zackowitz 2008:909). Children are spending more time indoors (due to the rise of technology and safety concerns of parents) and children are demanding more sophisticated toys, both of which limit the joys and benefits of simple, unconstrained play (MacBlain 2014 ch.4 sect.8). And although well-designed electronic media can enhance and stimulate a child’s learning, it is not very engaging (Hanna 2008:754). Physical toys and play thus have a great influence on a child’s development, since children are so prone to engaging with their environments and products therein (Lueder & Rice 2008d:471; Torres 2008:478). This section briefly elaborates on the choice of learning resources that parents and schools are faced with, and how this may affect language development, and how this may be influenced by the SA context.

2.5.4.1 CHOICE OF LEARNING RESOURCES AND THE EFFECT ON LANGUAGE DEVELOPMENT

A child’s language development is hugely dependent on the “quantity and quality of parent-child communication” – and more child-to-caregiver interactions encourage better language development (Loewenberg 2016). These kinds of language interactions can be facilitated with toy engagement, and Loewenberg (2016) and Cook (2016) both report on a study50 that appeared in the Journal of the American Medical Association Paediatrics regarding how the type of toys used by a child affects the language interaction between child and parent, and subsequently the impact that a type of toy has on the language development of the child. The study found that “electronic gadgets decreased the quantity and quality of a baby's language compared to books and traditional toys” (Cook 2016; Loewenberg 2016). This is due to the language usage of the parent when they facilitate play with the product in question – parents are far more vocally involved when using books and toys, than

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50 Association of the Type of Toy Used During Play With the Quantity and Quality of Parent-Infant Communication (2016) by A Sosa.
when using electronic learning aids (Cook 2016; Loewenberg 2016). Parents who are themselves prone to using and endorsing technology are particularly interested in “toys that teach” (Dewar 2015a), but they need to realise that these electronic toys essentially reduce the verbal interaction of both child and parent, and therefore stunt language development (Cook 2016; Loewenberg 2016).

Loewenberg (2016) admits that this is only one study, that has been conducted with a small sample group; but he remains adamant that parents should be sceptical of toys’ claims regarding the educational benefits that they offer, and he believes that a child’s development is best supported with a low-tech toy or book that allows for more engagement from both child and parent. Dewar (2015a) echoes this, by noting that there is very little research available to guide parents as to which toys provide the most effective educational experiences for children, and that most research is anecdotal – this goes for research of electronic toys, as well as conventional alternatives. However, Dewar (2015a) does proceed to concur with Loewenberg, by stating that some toys do provide engaging learning experiences as opposed to mere entertainment, for example construction toys, certain cooperative board games (which help promote analytical skills provided that they are used in conjunction with lessons on critical thinking), tangram puzzles (a Chinese puzzle consisting of seven shapes that make up a square), and mancala games (‘count and capture’ games with origins in Africa and Asia). With regard to language development in particular, Korngold (2015) is also in agreement, and warns that “[t]oo often, undemanding activities, like flipping through flashcards, are used to teach language”. Korngold (2015) subsequently urges educators and parents to engage children in activities that are “cognitively demanding and content-rich”, in order for a child to “experience language and not just be exposed to it through effortless repetition”.

2.5.4.2 Choice of Learning Resources within the South African Context

The introduction of computers into educational environments has been undeniably beneficial to learners, however the high cost of these is often a deterrent for financially challenged schools to invest in them (Contreras 2002). To compensate for the lack of technology available in some areas, the introduction of educational games and low-cost devices has shown a remarkable improvement in a child’s ability to learn, since – as mentioned above – expensive, high-tech learning resources are by no means superior to their low-tech, traditional counterparts (Contreras 2002; Cook 2016). It is unfortunate to note that parents from disadvantaged backgrounds tend to purchase electronic toys and learning aids (if they can afford them), due to the influence of marketing and social perception (Chang, Filipowicz, Golinkoff, Hirsh-Pasek, Newcombe & Verdine cited by Norton 2013). As such, disadvantaged children do not necessarily experience the benefits that traditional toys (which – ironically – are generally less expensive) have to offer. In addition to enhanced language development, these traditional toys (such as wooden blocks and puzzles) also encourage better holistic development of a child (physical, cognitive, emotional and social) by encouraging freedom of imagination and creative problem solving (City and Country School [sa]).
2.5.5 GOVERNMENT INTERVENTIONS FOR THE SUPPORT OF LANGUAGE DEVELOPMENT

In order to address the persistent problems with inadequate literacy skills, and in response to the poor results of national, regional and international adequacy studies, the DBE has attempted to introduce suitable intervention programs. This section briefly discusses the DBE’s reading initiatives, African language promotion policies, and resource development strategies. Even though there is evidence of reading campaigns and storybook distribution by the DBE, no indication can be found of the development or distribution of toys or assistive educational devices to support the learning and teaching of an additional language.

2.5.5.1 READING CAMPAIGNS AND INITIATIVES

In 2015, the DBE launched their ‘Read to Lead’ campaign in an attempt to facilitate and encourage a culture of reading. The campaign focused on improving the reading abilities of SA children with the aim of ensuring that “all learners are able to demonstrate age appropriate levels of reading by 2019” (DBE 2016b). Children need to be motivated to “make reading a lifestyle choice” in order to develop key skills associated with literacy (DBE 2016b). This is supported by the DBE’s ‘Drop All and Read’ campaign, which encourages schools to set aside a 20 to 30-minute period per week that is dedicated to a variety of reading activities (DBE 2014b:21). Learners, as well as teachers and support staff, are encouraged to engage in these reading activities (DBE 2014b:21).

As further provision for the improvement of literacy skills, and to support curriculum implementation, the DBE is aiming to provide the necessary infrastructure for the provision of library and information services to the majority of schools in the country that are without such facilities (DBE 2016a:15; DBE 2014b:20). The DBE is hoping to achieve this by trying to involve citizens through book drives, and through the donation of libraries and reading resources from NGOs and businesses (DBE 2016a:15,35).

Although the government has made attempts at implementing intervention programs in the past, both Fleisch (2008:26,29) and Gustafsson et al. (2016:10,51–54) warn that there is little evidence of these actually working. Gustafsson et al. (2016:10, 51–54) also caution that a number of earlier national reading strategies or interventions, irrespective of their promise, are simply no longer in circulation or have ceased to exist. To add to these concerns, the DBE needs to be wary of supplying schools with new infrastructure and resources without also facilitating the required training; as mentioned before, the mere presence of support resources is not enough to encourage learning, and steps need to be taken to ensure they are adequately used.
2.5.5.2 PROMOTION OF AFRICAN LANGUAGES

The DBE has also started introducing their Incremental Introduction of African Languages (IIAL) policy51. This policy aims to “promote and strengthen the use of African languages by all learners in the school system by introducing learners incrementally to learning an African language from Grade 1 to 12 to ensure that all non-African home language speakers speak an African Language” (DBE 2013:5). Through the IIAL, the DBE is hoping to strengthen the proficiency and development of the previously marginalized languages (at First Additional Language (FAL) level), and to increase access to languages beyond English and Afrikaans by requiring all non-African Home Language (HL) speakers to learn an African language (DBE 2013:5–6). The DBE hopes that this policy will “promote social cohesion by expanding opportunities for the development of African languages as a significant way of preserving heritage and cultures” (DBE 2013:5).

In the IIAL Draft Policy the DBE (2013:9) proposes that all learners from Grade 1–12 will be required to learn three official languages (one at HL level and the other two languages on – at least – FAL level). The implications for the FP are that learners will be required to add a second FAL to their curriculum (thus taking 5 subjects per year, starting in Grade 1), and that their instructional time will increase by two to three hours per week (DBE 2013:9,11). There is little indication of the feasibility of expecting children at this age to learn yet another language with which they are unfamiliar, however Lueder and Rice (2008d:401) do comment that due to the physiological structure of children’s brains, they are predisposed to learning certain skills (such as languages) quite readily. The DBE (2013:13–15) states that the Curriculum and Assessment Policy Statements (CAPS) documentation and all workbooks are already available to accommodate the additional subject, but they admit that teacher provision, teacher training, funding, and monitoring will require additional governmental support. Although this policy is commendable, the government’s inability to successfully implement the nationwide of teaching one language at FAL level in the FP brings into question their ability to manage the implementation of a second.

2.5.5.3 RESOURCE DEVELOPMENT

The DBE (2015a:62) contributes gradual improvements in academic success, in part, to their ability to provide and distribute DBE-approved workbooks and other teaching resources. In 2014 the DBE started developing and distributing a series of books for the FP, that are available in all 11 official languages at both HL and FAL levels (thereby encouraging home language instruction). The FAL reading series is presented as a range of ‘Big Books’, which allows for shared reading either amongst small groups of peers, or reading by the teacher to the class en masse (DBE 2014b:21).

51 The IIAL policy will be implemented incrementally stating with implementation in Grade 1 in 2015 and will continue until 2026 when it will be implemented in Grade 12 (DBE 2013:5).
In order to support the development of African language resources, the DBE has also started the *African Storybook Project* through which they hope to promote African language authors (DBE 2014b:21). The *African Storybook Project* is an online platform through which the public can access, submit, create, translate, or adapt storybooks, free of charge. Storybooks have been developed and approved in all 11 official languages (as well as other African and European languages), and the DBE (2014b:21) encourages schools and teachers to access as well as contribute to the *African Storybook Project*.

### 2.5.6 Research Limitations

Even though it has been mentioned that “[e]ducational toys make intuitive sense”, parents and educators need to be wary of relying on educational or electronic toys to facilitate learning, as very little research has been conducted regarding the support that such toys provide for child development, and marketing claims often cannot be substantiated (Loewenberg 2016; Torres 2008:492). It must, however, also be noted that very little research has been done regarding the opposite – for instance, that electronic toys are disadvantageous to language development (Loewenberg 2016). Caution must be exercised when drawing conclusions based on either opinion. The only claim that can be made with relative certainty, is that traditional toys have been proven to have a positive effect on learning, especially regarding language development. It is also safe to say that play activities with traditional toys elicit engaging conversation from adult facilitators (which subsequently stimulates language development), as opposed to electronic toys, which merely encourage behavioural regulation responses from parents or teachers (for instance, ‘push this button’ or ‘do not do that’) (Hirsh-Pasek cited by Belluck 2015). This study does not intend to substantiate or contribute to either bias towards educational or electronic toys, and merely acknowledges the research limitation that there is too little evidence to indisputably deem one toy-category superior to another.

### 2.5.7 Conclusion

The intention of this section was to present a sample of existing language development precedents, and to contextualise these within the research parameters that have been set throughout the literature review. This section provided a comprehensive overview of both high-tech and low-tech language development precedents, as well as conventional toys that support language development. Furthermore, this section provided insight as to the high-tech and low-tech resources that have been developed for the South Africa market, and looked at the government interventions that are being implemented in an attempt to improve literacy and language development. Notably, this section also examined the use of language resources, in terms of their effect on language development, and the influence of the SA context. Irrespective of the nature of the toy, children learn best when they are having fun, are actively engaged in the activity, and can relate to the topic of learning. Ultimately, the toys that are most beneficial, or ‘educational’, to children are not those that develop one skill in
isolation (such as an additional language), but those that also contribute to the development of integrated skills that are relevant in today’s world, such as collaboration, communication, creative problem solving, and confidence (Hirsh-Pasek & Golinkoff cited by Moretz 2008).

### 2.6 Conclusion

In order to conclude the Literature Review, this section is intended to identify the research gap, and establish some final observations regarding the secondary research that has been discussed. The research gap links to the problem statement and research questions, as it identifies the field that has not yet been adequately addressed. Identifying the research gap also shows that this study is not duplicating existing research. The remainder of this study reports on research that was conducted with the aim of filling this gap in the literature. The section concludes by drawing closing remarks regarding the necessity of this study, and the value of the secondary research that has been reviewed.

#### 2.6.1 Research Gap

The research gap that this study aims to address is the absence of an educational toy that focuses specifically on language development and additional language acquisition at the FP level, and that is purposely designed for the SA context from a user-centred perspective. Through the exploration of precedents, the research gap presents itself as the necessity for a design intervention that facilitates the learning – and teaching – of an additional language through creative play with the support of an educational toy, while simultaneously taking into consideration the demands of the SA context.

The importance of contextualisation needs to be reiterated. Not only do the physical traits of the end product need to be conducive to the SA environment (keeping in mind considerations such as modularity, durability, cost reduction and low maintenance, accommodating use by large groups, and being easily understood), but the learning material that is represented through the toy needs to be contextually relevant. The SA context requires special consideration regarding sensitivity to political history; diversity of race, culture and religion; and the dichotomy of the educational and socio-economic distribution. Subsequently, the impact of these factors on the representation and relevance (historical, cultural, geographic, and social) of pictorials and content needs to be treated carefully. In view of this, internationally developed games or toys that are reliant on icons or images are not necessarily conducive to the SA context. It is also important to note that the product needs to allow adult facilitators to provide the context and instruct the play-activity, especially with a low-tech product (since high-tech products can usually convey context and instruction through the user-interface). Furthermore, if an educational resource is to be successful in South Africa, it ideally needs
to adapt to accommodate all 11 official languages, of which the majority are indigenous to South Africa.

With regard to the precedents that have been designed for the SA context, both *African Voice* resources pose problems, irrespective of their ability to facilitate the development of critical thinking and language skills. The primary problem lies in the fact neither *Conversation Station* nor *Viva Vocab* offers a ‘fun’, engaging learning experience. Both products deserve to be credited with their singularity as locally developed, pertinent language resources, but since neither precedent provides a convincing play or game activity (as there is no game-play, no rules, and no goal), and since creative freedom is limited, the willing participation of young learners may be compromised. Furthermore, both products require facilitation from an adult who is capable of speaking the additional language, and active participation is limited to either mass or individual participation; either one child has the opportunity to respond (which disengages the remainder of the class), or an entire group has to respond simultaneously (which risks chant-learning and limits creativity). The language options are also limited to only the four most widely spoken official languages. The final concern regarding the *African Voice* range is that both products, especially *Viva Vocab*, run the risk of becoming repetitive and tedious as there is no opportunity for incremental learning, and there is only one – rather unimaginative – way of using each product. This being said, even though chant-learning is discouraged as a teaching method, children do learn through repetition, provided it is based on active engagement with the subject or topic of study (Korngold 2015). The *African Voice* precedents are commendable educational resources, especially since they prioritise vocabulary over other aspects of language acquisition, however the concerns that have been raised show they cannot be considered educational ‘toys’, and spontaneous engagement with the resources remains questionable.

Throughout the precedent study, several additional issues can be identified regarding both high-tech and low-tech language development precedents. For instance, word or letter-based board games are only transferrable between languages if the alphabets remain the same, which presents a hurdle for modular design. Another problem that came to light is that the number of participants that can be accommodated in play-activities tend to be limited, as a maximum of four or six players are generally allowed to participate. This is not conducive to use in big classes. Significant problems are also presented by the high-tech precedents that are available locally. Both the *GemIIni Program* and *Reading Eggs* focus on teaching English as an additional language and make no concession for learning an alternative language (Korngold 2015). Furthermore, both rely on expensive hardware that is not

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52 For instance, one can complete an activity in the home language, and then repeat the activity at a later stage in the additional language.

53 This does, however, confirm the necessity and importance of learning English within the SA context, as mentioned in Section 1.2.
necessarily available in rural or disadvantaged areas (where these resources would be most beneficial), and both are based on international platforms that have merely been adapted for the SA context. Since these resources were developed elsewhere, and without broader consideration for the SA environment, it is likely that they may encounter unforeseen problems in the long run.

Unfortunately, the number of locally developed precedents is limited, and although this restricts the availability of literature, it does allow for a promising design opportunity. This is where the research gap presents itself. With the support of the literature that has been reviewed, the researcher can develop a contextual understanding that allows for the design of a product that enhances a child’s development, complements the curriculum, and aids in facilitating the learning process. Most importantly, with a thorough understanding of what contextualises the SA paradigm, the proposed intervention can show consideration for product design requirements that cater for the needs and deficiencies of children from underprivileged backgrounds. This includes prioritising universal design considerations that would implicate the affordability, accessibility and usability of the device, however optimising these would not come at the cost of compromising product safety, which remains the preeminent design consideration. Furthermore, through the precedent study, the researcher can perceive what a successful educational resource needs to encompass, and this guides the direction of the additional research that needs to be conducted, and informs the final development of an educational toy for FP learners to aid in the learning of an additional language.

2.6.2 CLOSING REMARKS

The literature review concludes by drawing attention the necessity of recognising the impact of the SA context, and by reiterating the fact that poverty remains an underlying factor that “limits children’s mastery of reading and mathematics” (Fleisch 2008:51). Children from underprivileged schools are subject to an inadequate education caused by a combination of a misinterpreted curriculum; a lack of, or underutilised, textbooks; insufficient exposure to the dominating language of teaching in the home environment and throughout the FP; and teachers who insist on using ineffective methods and have poor subject and pedagogical knowledge (Fleisch 2008:138). The Minister of Basic Education, Angie Motshekga (2015b), promised that the DBE is working towards alleviating some of these problems by ensuring that all “learners have and use textbooks and workbooks, that the curriculum is covered … and that [learners] are screened and supported where they need additional support”. This, in combination with the comprehensive guidelines and policy documents that are provided by the DBE, may seem promising, but research warns that comprehensive teaching materials and resources are only beneficial if the teachers themselves are competent and use the material in an effective manner⁵⁴ (Reeves cited by Fleisch 2008:128). Although ineffective teaching practices

⁵⁴ This includes setting suitably demanding cognitive tasks, ensuring appropriate content exposure, and apt curriculum coherence and pacing (Reeves cited by Fleisch 2008:128).
(which are predominantly found in underprivileged schools) are partially at fault for the bimodal distribution of achievement, the SA community at large should adopt a strategy of motivation in order to alleviate the lack of knowledge and encourage progressive teaching methodologies, instead of resorting to criticism and blame (Coetzee, cited by UNISA 2012).

The design intervention that this study is undertaking aims to contribute to this strategy of motivation as a support resource for the teaching and learning of an additional language. Fleisch (2008:140) suggests that the only way a successful solution can be developed and implemented is if 1) conclusive research and evidence are presented of the underlying causes of failure, whereafter 2) it can be proved that the effective and sustainable intervention suggestion can be translated into practice by the state or implementing agencies, whilst 3) careful attention is paid to the possible unintended and unpredicted negative consequences of said intervention. Even though this study only proposes and tests (but does not implement) a design solution, these factors need to be taken into account throughout the research process. Fleisch (2008:76) does not make any suggestions for such interventions himself, but he reiterates that children need to be encouraged to become independent thinkers regardless of their socio-economic background, as a failure to do so stifles self-motivation and compounds the effects of underachievement.

In conclusion, it can be seen that a wide range of secondary research is available upon which to base the design and development of the final product. This research has reported on objective facts and knowledge which is accepted as true (extensive descriptive research), as well as specific exemplars (intensive descriptive research). This has allowed for an understanding of “how things are”, and for evaluation of the current situation, which has also lent itself to identifying how the proposed intervention can ameliorate this (Routio 2007 ‘How to create theory of design’). Although there are a few discrepancies of views in some of the schools of thought (such as the effectiveness of educational or electronic toys), the majority of the opinions correlate, and most of the academic texts focus on different aspects within certain theories, which broadens the researcher’s understanding. There is, however, a paucity of suitable academic texts on which to base some of the principles that have not been discussed in great depth, such as the requirements for the design of a product for children within a SA context. Hoadley (2016:47), as well as Jackson et al. (2016:5), reiterate that – due to the lack of suitable studies – there is need to make adaptations or generalisations regarding findings in both their fields (SA FP classrooms, and the learning of English as a home and additional language in South Africa respectively). This does, however, present an opportunity to conduct further research through interviews and additional primary research, in order to collect more, relevant data that contributes to addressing the research problem and informs the design outcome. The descriptive research reported here can be used as a basis for the intensive normative approach which follows, by supporting the understanding of how to improve the existing situation through the design of a product-based intervention.
CHAPTER 3 – RESEARCH METHODOLOGY

3.1 INTRODUCTION TO THE STUDY’S METHODOLOGY

This chapter provides a detailed explanation of the research plan, aids in delimiting both the theoretical and conceptual frameworks of this study, and guides the direction of the field research. The content that is covered in this chapter can be divided into two sections. The first identifies and discusses universal aspects of research methodology as they pertain to this study, namely the research paradigm, the research design and methodology, and the design process. The second section describes the location of the study, the sample, and the data collection and analysis methods. This is followed by an overview of the fieldwork that was conducted during various phases of the study. Before concluding, this section also identifies any ethical issues that were pertinent to the research.

The next section starts by identifying the research paradigm, design, and methodology. More specifically, it discusses the interpretive paradigm which denotes that individuals have unique experiences of various situations, and that the subsequent views and opinions that are based on these experiences result in qualitative, subjective data. The understanding that the researcher also experiences the world uniquely, and that this can contribute to, and enrich the research without tainting it, is also relevant to the study. The research design selected within the parameters of this study is action research design (3.2.2) that typically requires the collaboration of the researcher and the participants to generate new knowledge, which leads to instigating change at a local level in order to alleviate a perceived social problem (Cohen, Manion & Morrison 2005:226). This research design is reliant on repeating cycles of planning, action, observation and reflection, and allows the researcher the freedom to adapt to any unforeseen challenges. The study and chosen research design are further supported by descriptive, exploratory and heuristic methods of research (3.2.3).

Based on the aforementioned interdependent topics, the section continues by describing the design process that was followed in this study (3.3). The spiralling action research cycle reflects the iterative steps of a user-centred design (UCD) approach, as well as the adapted traditional design process, and an amalgamated design process was adopted based on these three approaches. Instead of following the traditional linear design process, the design process of this study allowed for the constant revisiting of the design, and as feedback was received, the design was reflected upon, amended, and further observations were noted.

The discussion in Section 3.4 is very specific to this study: it locates the study and elaborates on the two target areas that are included in this study: a privately operated learning facility, The Link, that
supports literacy and the low-cost independent schools at which the facility operates. This is supplemented with a brief explanation of The Link’s approach to supporting literacy development.

The following section serves to describe the methods that were used to collect and generate data, the sample groups that participated in the study, and the data analysis, as well as the reasons why these were chosen in light of the research study (3.5). The reasoning for these choices was driven by the purpose of the primary research (Cohen et al. 2005:73,270), which was to develop a deeper understanding of the research problem based on the subjective views of participants. This lent itself to the use of a small sample group and all other decisions were guided by this. The three data collection methods utilised through the primary research were interviews, feedback forms (based on typical questionnaires), and observations by the researcher (3.5.1). Section 3.5.2 continues by identifying the participants that contributed to the primary research. Section 3.5.3 describes the data analysis methods, consolidates of data, interprets the data through triangulation, discusses the validity and reliability of the data collection methods, the resultant findings, and the transferability of the findings. The field work conducted during various phases of the study is then reported (3.5.4).

Before concluding, this section also identifies ethical issues relevant to the study (3.6). The two topics that are most pertinent to this study include the involvement of children (3.6.1), and being granted consent (3.6.2). The matter of consent was addressed through the consent granted by institutions, and the informed consent of participants. Furthermore, this section discusses ethics in terms of data collection methods, the beneficence and non-maleficence principles, and matters that specifically relate to the field of design (3.6.3, 3.6.4 and 3.6.5 respectively).

Research Methods in Education (2005) by Louis Cohen, Lawrence Manion and Keith Morrison is a seminal work in the field of educational research. Throughout their book, the authors discuss relevant theory and provide in-depth descriptions, examples, and practical guidelines for conducting educational research. The authors address various research methods, data collection methods, validation of data, sampling techniques, and research ethics, and provide objective valuations regarding the advantages and disadvantages of all. The comprehensive overview provided by Cohen, Manion and Morrison (2005) directed the researcher’s decision making regarding the research methodology of this study, and guided the design of the various data collection instruments.

3.2 RESEARCH PARADIGM, DESIGN AND METHODOLOGY

This section discusses three interdependent topics: the research paradigm, the research design, and the research methodology as they were defined in the context of this study. This qualitative study is placed in an interpretivist paradigm, which favours an action research design approach (which links to UCD). The descriptive, exploratory and heuristic research methodologies employed
complement the theory of design (see 1.6). The integration of the chosen research design and methodologies, as they pertain to this study and the design process, are described in 3.3.

### 3.2.1 Research Paradigm

The belief system that governs the course of this study is based on the interpretivist paradigm. The study is predominantly based on qualitative data, such as the beliefs, values and opinions of participants, sources, and the researcher, as opposed to quantitative data, which is typically based on measurable, numeric values or variables. The only quantitative data that contributes to this study is anthropometric data relating to the dimensions of the final product. A typical interpretivist approach proposes that individuals construct their own reality\(^1\), or that they interpret the world according to their own lived experience, and as a result there are multiple, subjective interpretations of a scenario (Munro 2014:52; Macleod 2009). It is the understanding and structuring of these individual views that make the researcher a subjective and empathetic participant in the system, rather than a mere observer (Macleod 2009). Although generalising in a qualitative paradigm is not encouraged due to the unpredictable and subjective nature of the research data, and the influence of the researcher, transferability is an option whereby the research outcome can be hypothetically applied from one context to another\(^2\) (Dudovskiy 2016; Munro 2014:52). This does, however, need to be disclosed as the reliability or representativeness of such data may be compromised due to the specificity of either the location or sample (Dudovskiy 2016). An interpretive approach also relies on the context to inform the conclusions of the research, which results in a deeper and more holistic understanding of a situation (Pronger 2012).

The underlying means of gathering data for qualitative research is based on triangulation\(^3\) – whereby the researcher is required to interpret and analyse the ‘lived experiences’ or explanations, from multiple fields or sources, with the intention of comparing them and having them influence, reinforce or even contrast one another (Munro 2014:55; Sagor 2000). The data required for studies done in a qualitative paradigm lies with the people who form – or inform – the subject of the study, and with how they interpret the world, which is why qualitative approaches are best suited to matters of social inquiry (Dudovskiy 2016; Munro 2014:53). This data ideally yields a ‘thick description’\(^4\). A qualitative paradigm allows researchers to gain an understanding into subjective motivations, and to gain insight

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\(^1\) It is important to note that researchers themselves also experience the world uniquely, and that they also interpret the world differently and thereby contribute to the research (Munro 2014:52). The interpretive paradigm can often result in competing explanations of similar realities, and as a result data is largely qualitative (Dudovskiy 2016). Findings are not absolute and cannot be generalised; rather, findings tend to be idiosyncratic, and the results depend on the identification of data trends and clusters of shared opinion.

\(^2\) See Section 3.5.3 for further elaboration.

\(^3\) Munro (2014:54) states, irrespective of its name, triangulation can refer to two, three, or even more fields or sources of information.

\(^4\) Which refers to an in-depth, multidimensional understanding of a context through objective observation, interviews, literature reviews and retrospective, empathetic reflection (Munro 2014:56–58).
into the experiencing of a problem, thereby uncovering prevalent trends in thought and opinion (Labaree 2015). Direct interaction with participants provides researchers with the opportunity to understand a more realistic worldview that cannot be uncovered through statistical analysis, and allows them to respond to a local situation and the direct needs of participants (Labaree 2015).

### 3.2.2 Research Design

In light of the nature of this study, and having chosen a qualitative research paradigm, action research design was identified as the most suitable methodology to utilise for further research. An action research design approach is based on a cycle that aims to promote the wellbeing of communities or individuals, or to improve a perceived social problem, through change (Hayman & Popplewell 2012:1; Routio 2007 ‘Action research'; Cohen et al. 2005:226,231). Action research is intended to address a specific problem in the short term (in the case of this study, the need for supporting the teaching of a FAL at FP level), and to inform larger issues in the long term (in the case of this study, ameliorating the achievement gap, breaking the cycle of poverty and encouraging better educated future generations) (Abalos 2011:7). This action can range from changing or improving existing structures to designing practical solutions through products for an identified social problem (Hayman & Popplewell 2012:1; Routio 2007 ‘Action research'; Routio 2007 ‘How to create theory of design').

With action research design, it is common for a researcher to approach members of a target community in order to solve the identified problem. The researcher does, however, not necessarily have to be experienced in the field in which the problem lies (in this study, FP education), but addresses the problem from a new vantage point (in this study, an industrial design perspective), and thereby offers the target community his/her own theoretical knowledge and skills (Routio 2007 ‘Action research'). The researcher and the participants collaborate in order to generate new knowledge that forms part of the research (thus making it an emergent research approach), however the participants are not necessarily involved in the design process (Hayman & Popplewell 2012:1).

Action research is dependent on self-reflection and self-evaluation to develop a better and more holistic understanding of a situation (McNiff 1995). This research design is implemented to “achieve [both] understanding and change” simultaneously (Dick 2002). These factors validated the choice of an action research design approach for this study.

An action research design follows a spiralling cycle\(^5\) that is based on planning, acting, observing and reflecting (see Figure 27) (Cohen et al. 2005:79; McTaggart 1989). An understanding of a problem

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\(^5\) The action research approach also closely reflects Routio’s normative approach which allows for the iterative participation of users throughout the research process (Routio 2007 ‘How to create theory of design’). Moreover, Routio’s theory of design which also strives for the “need of improvement”, allows for the following
is developed through self-reflection, analysis of available literature, data collection and other exploratory methods, which in turn leads to planning a strategy of intervention. The intervention is carried out (action) and observations are made. These findings are reflected upon and a revised strategy is adopted. This cycle is repeated until a sufficient understanding is achieved, or a suitable solution has been developed (Labaree 2013). (It is apparent that the action research approach and UCD pertain to one another, and the convergence of these is discussed in 3.3.) The reflection stage is critical before continuing with the next iteration as it allows the researcher to analyse the previous steps and strategise the best way forward (Routio 2007 ‘Action research’; Cohen et al. 2005:229; Dick 2000). Although a study might commence with vague goals, these iterative cycles and the critical analysis by the researcher aid in focusing the study (Dick 2000). As the spiral ‘intensifies’, the researcher’s knowledge increases, but simultaneously this allows the solution to become more focused and specific. Data collection methods that are conducive to action research include focus groups, observations, interviews, questionnaires, surveys, visual records, field notes and journals (MacDonald 2012:41; Cohen et al. 2005:237) (see 3.5.1 for elaboration).

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**Figure 27:** A typical action research spiral.
(Kemmis & McTaggart 2007:278)

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steps: identifying the problem; delimiting the scope; evaluating the ‘present state of things’ through both primary and secondary research; planning the procedure of development (analysis of findings and subsequent product development); testing; and decision making (Routio 2007 ‘How to create theory of design’).

Hummels and Overbeeke (2013 ‘Industrial design’) also elaborate on the importance of both reflection and action in industrial design in general, as both of these contribute to an “understanding that arises from experience”, irrespective of the research approach.
Action research is typically a responsive, flexible and emergent research design – as it allows the researcher the ability to adapt to emerging challenges and changes that present themselves throughout the research process (Dick 2000). Due to this nature of action research, it typically means the researcher has no pre-emption of the direction that the study will take, which prevents personal bias from affecting the outcome of the study7 (Labaree 2015). Action research design encompasses both problem solving (action, or practice) and learning through the process (research, or theory) – thus yielding outcomes of both change and information (Labaree 2015; Cohen et al. 2005:79,227,237; Dick 2000). The direct and apparent impact that action research has on advocating for change, and it’s focus on “solution-driven research outcomes rather than testing theories” means that practitioners who engage in such research studies “inevitably find it to be an empowering experience” (Routio 2007 ‘Action research’; McGinty & Waters-Adams 2006; Sagor 2000). Furthermore, action research design has great appeal to researchers in the fields of art and design, as they tend to have a greater interest in problem solving tangible outcomes, rather than proving scientific hypotheses (Dewey, cited by Hummels & Overbeeke 2013 ‘Industrial design’). Action research design is also often used in the field of education, as it allows for opportunities to explore various teaching topics and methods, curriculum development and student behaviour (McGinty & Waters-Adams 2006; Cohen et al. 2005:226; Sagor 2000). Additionally, there is always ‘room for improvement’ in the education field, and the iterative approach allows for continued reflection which leads to improved processes (McCallister 2014). Due to the combined educational and design aspects of this study, it became clear that an action research design approach would be most appropriate.

3.2.3 RESEARCH METHODOLOGY

The research methods that were used for this study included descriptive, exploratory and heuristic methods. The descriptive method was used to determine the ‘who, what, when, where, and how’ of the research problem and essentially described what already existed in a particular situation (Labaree 2013; Routio 2007 ‘How to create theory of design’). Descriptive research was used in conjunction with qualitative methods to allow participants to define topics on their own terms (Labaree 2013). Exploratory research8 was incorporated to build on the findings of descriptive research by identifying the reason (the ‘why’) for a situation’s existence (Labaree 2013). This method is used in cases when there are limited studies to refer to, or if a topic necessitates deeper understanding. The focus in this study was to gain deep insight (which resulted in rich data, or a ‘thick description’) from a small sample size, but required refraining from generalising these findings to a larger sample (Dudovskiy 2016; Munro 2014:52,56–58; Labaree 2013). The exploratory

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7 Although personal bias does become a concern when considering the personal involvement of the researcher in the research context (Labaree 2015).
8 What Routio (2007 ‘Theory of furniture’) refers to as the intensive normative approach.
research aided in evaluating the research problem, and subsequently informed the design of the proposed intervention.

What descriptive and exploratory research could not provide, was compensated for with heuristic research. Heuristic research is generally based on the personal experience and expertise of the researcher (Kleining & Witt 2000). From an industrial design perspective, Hummels and Overbeeke (2013 ‘Industrial design’) also encourage designers (in this study, also the researcher) to make unbiased decisions based on intuition and “common sense”\(^9\). Furthermore, a researcher typically experiences growing self-awareness as a situation is understood more accurately and, as a result, the researcher’s individuality and views can be expressed (Kleining & Witt 2000). It is apparent that heuristic research is strongly associated with reflective practise in the action research cycle.

3.3 DESIGN PROCESS

This section describes the design process that was followed throughout this study. It first provides an overview of the design process and explains the integration of the UCD approach and the action research cycle then a breakdown of the phases of the study follows.

3.3.1 OVERVIEW

The design process that this study followed is an amalgamation between the traditional design process and the UCD process. This combination is well supported by the spiralling action research cycle. The traditional product design process typically consists of five steps: the brief, the research, the design or product development, amendments, and final production (see Figure 28) (Boulton 2009:42). This linear design process tends to be rigid, has potential for miscommunication, and does not allow for sufficient user testing or feedback. This is why Boulton (2009:44) suggests that a product design process should rather “follow a series of iterative stages, incorporated into an overall linear process”. This approach incorporates both the UCD process (2.4.2.5), and the spiralling action research cycle (3.2.2).

\(^9\) Hummels and Overbeeke (2013 ‘Industrial design’) concede that due to its non-replicable nature, ‘intuition’ is not a formal methodology, yet they believe it a credible, indispensable and empowering tool in the confines of design disciplines
When comparing the traditional product design process, the action research approach, and the UCD process, it is evident that there are three stages that are common among them (see Figure 29). Stage 1 can be defined as the ‘preparation’ stage; Stage 2 can be defined as the ‘design’ stage, and is where the various cycles and iterations take place; and Stage 3 can be defined as the ‘resolution’ stage.
Identification of these commonalities allowed the researcher to combine the three processes in a way that best suited this study. The amalgamation of these resulted in the design process that is depicted in Figure 30, and shows aspects of the traditional product design process, the UCD process, and the spiralling action research cycle (which also reflects Routio’s aforementioned normative approach). Figure 30 also provides a breakdown of the various phases of research and design (indicated by numbers and demarcated with purple blocks), and depicts the distinct iterations that were necessary. As per the traditional product development cycle, this study went through stages of conceptualisation, development and refinement, but relied on user testing and feedback, and subsequent analysis and reflection to support the iterative cycles. The remainder of this section describes each stage, and ensuing phase, of the design process.

Figure 30: The design process that was followed for this study. (Chart by author, 2017)
3.3.2 STAGE 1: PREPARATION

As mentioned before, the first stage of the design process can be defined as the ‘preparation’ stage, as this is the stage during which all preliminary planning and research were conducted, prior to the commencement of any design. This stage formed the basis of the ‘planning’ step of the action research spiral, which in turn informed the second ‘action’ stage. This first stage of the study was divided into three phases, and the researcher’s engagement with this process is described below.

**PHASE 1**

The amalgamated design process started with the identification of a problem (1.2, 1.3 and 1.4), whereafter a general brief was developed, as per the traditional design process. The brief outlined the aims and deliverables of the project and was used to determine the scope of the study (1.5), in accordance with the action research spiral and Routio’s normative approach.

**PHASE 2**

Upon finalisation of the brief, the initial research phase commenced, which provided insight into the problem and helped the initial generation of ideas for the design solution in a ‘real-world context’ (Boulton 2009:42). This inquiry was conducted in the form of secondary research, and involved the systematic and organised gathering of information (with a focus on users and their tasks), and was compiled and presented as a literature review.

**PHASE 3**

The secondary research informed the identification and selection of participants, and the basis of inquiry needed for the preliminary primary research. This was the first phase that involved field research. During this phase, the primary research consisted of data collected through interviews with selected participants.

3.3.3 STAGE 2: THE ITERATIVE CYCLES

The second stage of the design process was the longest and most significant stage. It was during this stage that the various iterations and cycles occurred, and where the phases of product development ensued. In addition to the design development, the majority of heuristic research, analysis, evaluation, and reflection transpired in the second stage. Although the first stage involved users in the initial primary research, the second stage relied on user involvement throughout the design and development iterations (following both UCD and Routio’s normative approach). As per the action research cycle, the second stage was where the intervention was carried out (action), observations were made and reflected upon, and a revised strategy was adopted (typically involving amendments to the design, as per the fourth step of the traditional design process). This cycle was repeated until a sufficient understanding was achieved, and a suitable solution was developed.
(Labaree 2013). Boulton (2009:44) is adamant that a good design process involves frequent testing or feedback opportunities, to reduce the number of amendment stages that are required. For the purposes of this study, three iterations were necessary for a suitable solution to be developed.

**Phase 4**

The fourth phase of the design process required the analysis of the secondary and primary research findings. Even though the – predominantly qualitative – data (from both primary and secondary sources) was varied, analysis of the data (through triangulation) identified a number of common themes which informed the conceptualisation of the design intervention (Kleining & Witt 2000).

**Phase 5**

The previous phase’s evaluation of and reflection on the data allowed for a thorough, holistic understanding of the research problem (or an evaluation of the ‘present state of things’ (Routio 2007 ‘How to create theory of design’)) as described by participants, which led to establishing a set of design requirements. These guided the product development throughout the design process, and were used to evaluate the final design intervention. These design requirements specifically considered suitability for the SA context, as well as user requirements.

**Phase 6**

The analysis of various sources of data – secondary, primary and heuristic – of Phase 4, and the resultant set of design requirements established in Phase 5, fed directly into the first design iteration which started in Phase 6. The design conceptualisation was greatly influenced by the aforementioned design requirements, the participants’ opinions and the precedents that were discussed in Section 2.5. Conceptualisation started with visual research that was presented as research boards, whereafter initial concept sketches and block models displayed a variety of potential design solutions. From here, the researcher used her own judgement and expertise to select four distinct directions that had the most potential for addressing the research problem. These four concepts were presented to the participants for feedback regarding the proposed solutions. This feedback was specifically focused on product use, from both learners’ and facilitators’ perspectives.

**Phase 7**

Feedback from the participants was analysed and reflected upon, and the initial concepts were gauged according to the design requirements. Based on this, the researcher selected the concept that proved most promising, and further developed the product according to the feedback and revised findings. The design development phase required some additional secondary research regarding material choices, manufacturing processes, and content development, as well as development sketches and mock-ups. This phase included the development of a CAD model, and resulted in the production of a set of prototype samples. These samples were provided to the
participants, who tested the models themselves and with learners in various learning environments. In addition to facilitator observations and feedback, the researcher also made her own observations of the product in use in various learning environments. The researcher was a passive, unobtrusive observer in the classroom, and made notes regarding the use of the refined product, and noted potential further improvements or amendments. Supplementary discussions with the participants regarding the product, subsequent to field testing, concluded this phase.

**Phase 8**

As per all design iterations, the design refinement phase commenced with the analysis of the user feedback, and reflection on these findings. Based on these, suggestions for amendments to the design intervention were made, but not implemented; time and budget restrictions only allowed for conceptual realisation of the refined product, and thus, no further prototyping, testing or observations were undertaken. For the academic purpose of this study, the proposed refinement descriptions depict the final design outcome. This phase concluded the design iteration stage, and was followed by the third and final stage of the design process.

**3.3.4 Stage 3: Evaluation and Study Conclusion**

Where the first and second stages of the design process are quite similar among the three approaches compared in Figure 29, the third stage is where the approaches deviate most, depending on the desired outcome of the design process. The third stage can refer to: manufacture and production, in order to take the product to market (traditional design process); implementation of the design solution, when conducting a social intervention (UCD); or merely design or research finalisation (action research approach). For the purpose of this study, the third stage of the design process involved the heuristic evaluation and proposed development of the design intervention.

**Phase 9**

Once the design had been refined, the researcher commenced with an objective, heuristic evaluation of the proposed design intervention. The final evaluation was based on the criteria used to assess the efficacy of the design (identified in 1.5), as well as the design requirements that guided the product design process.

**Phase 10**

The final phase draws the study to a close by touching on all the various aspects that were reported in the dissertation document. Phase 10 covers the fifth and final chapter of this dissertation, which summarises the critical findings of the study, revisits the research question, and makes recommendations for further research.
3.4 LOCATING THE STUDY

The primary test areas for this study were limited to urban institutions and organisations in and around the Johannesburg region that use English\(^{10}\) as their LOLT. Although South Africa has 11 official languages, the focus of the study was narrowed in order to keep to a realistic time frame. However, since this study is based in a qualitative paradigm, it does allow for the results (the design intervention) to be transferred to similar contexts (in the case of this study, to contexts that need to facilitate the learning of a different language) (see 3.5.3 for elaboration on transferability).

Two target areas were included in this study. The first was a privately run learning support programme – The Link Literacy Project – and the second was three of the low-cost independent schools at which they operate. The Link Literacy Project is an NGO that runs both literacy and numeracy programmes in “low-income schools in Johannesburg” (The Link [sa]). The Link specifically focuses on supporting literacy in children who have English as their second language and who have limited exposure to English in their home environment. The Link currently operates 11 centres at schools in and around Johannesburg, and are reaching approximately 1000 FP learners per week through their programmes (The Link [sa]). Each centre is staffed by trained volunteers who spend 45 minutes a week supporting the development of English literacy through a one-on-one basis with a learner who has been identified to “be at risk of not achieving their potential” (The Link [sa]).

The Link Literacy Project was enthusiastic to partake in the research study as there was a mutual benefit to all parties involved. The researcher approached The Link centres (LC1, LC2 and LC3) operating at the following three schools: a Johannesburg school that preferred to remain anonymous, Salvazone Christian School (Brixton, Johannesburg), and Nokuphila School (President Park, Midrand) (S1, S2 and S3 respectively). All three of these schools are small, independent schools that cater predominantly to learners from low-income households. The first school differs slightly from the others, as most – but not all – of their learners present with remedial or ‘special’ needs. Although the schools involved in this study are better funded, equipped and staffed than some government-operated schools, the learners from these test areas are still predominantly from low-income or disadvantaged backgrounds, and their particular needs are still representative of the majority of SA school children. Through The Link representatives, the researcher was put in touch with the principals and FP teachers at each school. All three schools and their teachers fully support

\(^{10}\) English might only the fourth most commonly spoken HL in South Africa (after isiZulu, isiXhosa and Afrikaans), but it is nonetheless the most widely understood and is the country’s lingua franca (Index Mundi 2014). It is also important to remember that even though the FP is taught in all 11 official languages in South Africa, from Grade 4 onwards all classes are taught in exclusively in English (or Afrikaans, at Afrikaans schools) (Bloch cited in Cook 2013).
and endorse the support services that The Link offers (The Link [sa]), and were also willing to participate in the research study.

### 3.4.1 Understanding The Link’s Approach to Literacy

As the three schools already had The Link’s literacy programme in place as an assistive learning measure, this could be used as a springboard for the design of the end product. Furthermore, The Link already has existing assistive infrastructure and resources to encourage language development, and the facilitators are attuned to the specific learning challenges that learners in the SA context are faced with. The Link’s programmes focus on learners in Grade 2 and Grade 3, which was conducive to limiting the scope of the study to learners in the FP of their education. Herewith follows a brief overview of The Link’s approach to literacy teaching and learning, and an explanation of how their programme is intended to support learners with the acquisition of English.

The Link’s literacy programme consists of two 45-minute sessions per child per week at each school. Each session is facilitated on a one-on-one basis, where one volunteer is responsible for one learner. Where possible, The Link aims to provide volunteers to accommodate literacy support for an entire class, however, if this is not possible, The Link’s programmes do specifically target the weakest learners in the class. Each session consists of three 15-minute slots: the first is devoted to paired reading, where the learners read to their facilitators (provided the learners are able to read); the second is spent on a learning activity, such as playing educational games to improve phonemic awareness or practising hand writing; and the third is dedicated to story-reading (or immersion reading) by the volunteer to the learner, to encourage an appreciation of literacy and immerse the learners in the English language. All thee slots are intended to reinforce one another by subjecting the learners to a variety of learning approaches.

As mentioned before, The Link’s programmes specifically focus on Grade 2 and Grade 3 learners, although ages fluctuate from the expected 7 to 9 up to 11 or 12. In some cases, some of the learners are older than their classmates, because they are not at the same emotional maturity or developmental stage as other FP learners and therefore have not been promoted to higher grades. In other cases\(^{11}\), learners tend to be between the expected ages of 7 and 9, and even though their emotional development is on par with what would be expected from FP learners, their cognitive or academic development is poor.

All learners who are supported by The Link’s literacy programme are assessed at the beginning of the year to determine their reading capabilities, and are allocated to a suitable ‘learning level’

\(^{11}\) The former can be expected with learners who attend LC1, at S1, which tends to deal with learners who have special needs.
(denoted by colour). This reiterates The Link’s personalised approach to literacy development, whereby the volunteers organise their sessions according to the learners' capabilities. The reading levels are determined by the learners’ performance in the preliminary assessment, and are used as a baseline to gauge learners’ progress throughout the year. The levels are indicated by specific colour groups, and are determined as follows:

<table>
<thead>
<tr>
<th>Level</th>
<th>Grade 2</th>
<th>Grade 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 0</td>
<td>Pre-Red</td>
<td>50% and below</td>
</tr>
<tr>
<td>Level 1</td>
<td>Red</td>
<td>51% to 65%</td>
</tr>
<tr>
<td>Level 2</td>
<td>Orange</td>
<td>66% to 75%</td>
</tr>
<tr>
<td>Level 3</td>
<td>Yellow</td>
<td>76% to 85%</td>
</tr>
<tr>
<td>Level 4</td>
<td>Green</td>
<td>86% to 100%</td>
</tr>
<tr>
<td>Level 5</td>
<td>Pink</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Blue</td>
<td>–</td>
</tr>
<tr>
<td>Level 6</td>
<td>Gold</td>
<td>–</td>
</tr>
</tbody>
</table>

Table 1: Determination of reading capabilities and appropriate levels according to preliminary assessment results for Grade 2 and Grade 3 learners. (Table by author 2017)

During the Pre-Red level, learners are typically still battling with simple phonemic pronunciation, or the sounding of the letters of the alphabet. Pre-Red learners typically cannot read at all, and sessions are spent identifying and practising basic sounds. From here, the levels progress incrementally, where Red learners practise blending and segmenting three-letter words; Orange learners practise four-letter words and digraphs; Yellow learners are introduced to long vowel sounds (for example, ‘ai’, ‘ee’, ‘ea’, ‘ow’, and ‘ie’) and elementary sight words; and learners who are on the remaining levels are introduced to progressively more complex sounds and challenging words, and facilitators support reading fluency, comprehension and vocabulary expansion.

3.5 DATA COLLECTION METHODS, THE SAMPLE AND DATA ANALYSIS

The following section aids in clarifying the data collection methods, the sample groups, and the data analysis methods that were used for this study. The section begins by discussing the three different data collection methods that were used in this study, keeping in mind that this study is framed within an interpretivist paradigm and relied on qualitative data. The section continues by describing the various participants and sample groups that contributed to the primary research component of the study, and explains the reasons for choosing these particular sample groups. Hereafter, the section

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12 Two letters that make a single phoneme, or sound, for example ‘ch’, ‘th’, ‘ng’ and ‘sh’.
13 The most frequently occurring words in children’s books. Additionally, these words usually cannot be ‘sounded out’, and need to be recognised by sight.
concludes by briefly discussing the data analysis methods that were used to examine the primary research. The actual dissemination of findings can be found in Chapter 4. The principal theme dictating the choice of data collection, analysis methods, and sample groups was driven by, as Cohen et al. (2005:270) suggest, their ‘fitness for purpose’.

3.5.1 DESCRIPTION OF DATA COLLECTION METHODS

As mentioned earlier, data collection methods that are conducive to action research design include focus groups, observations, interviews, questionnaires, surveys, visual records, field notes and journals (Cohen et al. 2005:237; MacDonald 2012:41). The three main methods that were employed at various phases in this study were interviews, feedback forms (based on facilitator observations) and researcher observations, each of which is described below. These three methods were used to garner descriptive and exploratory research which built an understanding of both the research problem and the proposed design intervention, as defined and experienced by the participants. At this point, it is important to reiterate that even though the UCD approach necessitates the involvement of ‘users’ in the design process (Abras, Maloney-Krichmar & Preece 2004:1; Rubin, cited by Henry & Thorp 2004), the participants need not be directly involved in the design process per se, and that their involvement can be limited, as in this study, to interviews, product testing and direct observation (Abras et al. 2004:5–6). Each section below starts with a brief overview of the data collection method, followed by its purpose and pertinence to the study, the design thereof in relation to the study, and how the data was captured and recorded.

3.5.1.1 INTERVIEWS

The first method of data collection was conducting one-on-one interviews that were conducted during Phase 3. Conducting interviews allows researchers the opportunity to directly gather information from study participants regarding the participants’ “interpretations of the world in which they live, and to express how they regard situations from their own point of view” (Cohen et al. 2005:267). The advantage offered by interviews over questionnaires and surveys are that they allow for a greater depth of understanding, but this comes at the cost of: reliability, depending on sample size; anonymity, which may impact participants’ honesty; and being prone to subjectivity (Cohen et al. 2005:269). The biggest risk with relying too heavily on interviews is that – despite all attempts at being systematic and objective – the data gathered from interviews is, by nature, subject to bias and “the constraints of everyday life” (Cohen et al. 2005:268).

Cohen et al. (2005:273) identify four main types of interviews: structured, unstructured, non-directive, and focused interviews. Patton (cited by Cohen et al. (2005:271) adds to this a guided interview approach, or semi-structured interviews, which is what this study relied on. During semi-structured interviews, questions and topics that need to be covered are outlined in advance, and the researcher has the freedom to decide the course, flow and wording of the interviews and is at liberty to ask non-
scripted follow-up questions (Patton, cited by Cohen et al. 2005:271). The inclusion of predetermined questions does, however, allow for consistency of wording, and subsequently moderates the comparability of responses (Patton, cited by Cohen et al. 2005:271). Although it is important for the researcher to ask each participant the same questions, Oppenheim (cited by Cohen et al. 2005:270) states that standardisation need not rely on “replicating exact wording”, but should instead ensure that each participant understands the question in the same way. This means that although the objectives of the research guide the questions that are asked, the researcher is at liberty to adjust “their content, sequence and wording” (Kerlinger, cited by Cohen et al. 2005:273). As a result of this, this type of interview tends to remain fairly informal and conversational (Patton, cited by Cohen et al. 2005:271).

The first-hand experience and data that result from interviews was particularly pertinent to this study, as this contributed to the researcher’s understanding of design considerations for a product in a SA context – a topic that required further investigation as per the identified research gap. Due to the nature of the required information – a deep qualitative understanding, preferably from multiple sources – interviews were deemed most fit for this purpose. The interviews that were conducted for this study served two main purposes: the initial and final interviews were used as a means of collecting information that had a “direct bearing on the research objectives”; and intermittent follow-up interviews were used in conjunction with feedback forms in further research undertaking (Cohen et al. 2005:268).

The interview process followed the seven stages set out by Kvale (cited by Cohen et al. 2005:274): formulating the theme and purpose of various interviews; designing the interviews in such a way that the questions adequately reflected the information that was sought; conducting the interviews; transcribing audio recordings of the interviews into written text without losing data or misconstruing events; analysing findings; verifying findings by ascertaining their reliability, validity and transferability; and reporting findings. Interviews included a combination of direct and indirect, general and specific, and closed and open-ended questions. Interviews were split into three parts, and participants were made aware of this, and as such they could anticipate the change in interview style. Closed questions were used to define necessary demographics (descriptive research); multiple choice questions aided in delineating priority of design requirements (exploratory research); and open-ended questions were useful for exploring and understanding the research gap, and requesting suggestions for improvement that the researcher might have overlooked (descriptive and exploratory research). The open-ended questions specifically allowed for responses that reflected the participants’ frame of reference (education), instead of the researcher’s (design), and due to the unguided nature of these questions, they encouraged greater honesty from participants (Labaree 2013; Cohen et al. 2005:270,275; Tuckman, cited by Cohen et al. 2005:276).
The interviews were conducted in person and the data was captured through audio recordings (which were later transcribed), as well as notes made by the researcher during the interviews. Photographic recordings were also made as and when necessary. The field notes highlighted salient points, guided follow-up questions, and allowed the researcher to jot down any thoughts regarding design requirements\textsuperscript{14}.

\subsection*{3.5.1.2 Feedback Forms}

The second method of data collection was the distribution of questionnaire-style feedback forms. These were distributed during the design iterations, particularly during phases 6 and 7. Questionnaires are a useful tool for collecting structured data (that is reasonably simple to analyse) without the presence of the researcher, however, they do take some time to develop, and they pose the risk of deliberate falsification of data by respondents, or unintentionally biased interpretation or misrepresentation of data by the researcher (Cohen \textit{et al.} 2005:245,254–255). Small-scale studies, such as this one, are particularly well-suited to open-ended questionnaires, in order to establish honest, authentic, and unguided comment from participants through questions and sentence completion without guidance from the researcher (Cohen \textit{et al.} 2005:255).

These forms guided the feedback process by giving participants an indication of what to look for and take note of during interactions with the product\textsuperscript{15}. The feedback forms were intended to record the teachers’/facilitators’ experiences, observations and reflections of using the product prototypes in the intended environments. Although the opportunity to probe participants (as in the interviews) was forfeited, a benefit posed by the feedback forms was that participants had the opportunity to complete the forms immediately after having used the product, and participants did not have to rely on memory to provide responses (as would have been the case with interviews). The researcher compensated for this through impromptu, unstructured follow-up interviews with the relevant respondents in case further clarification was sought. This was considered an acceptable compromise due to the benefits posed by the feedback forms regarding the consolidation of data.

The design of the feedback forms was based on guidelines provided by Cohen \textit{et al.} (2005:245–266) regarding the design of questionnaires. The feedback forms were semi-structured, which allowed for a range of closed and structured questions (which allowed for easier comparison of responses (Cohen \textit{et al.} 2005:248)), as well as open and unstructured questions to be included.

\textsuperscript{14} Although audio recorders receive criticism for constraining the answers of participants, they are unobtrusive and allow for capturing as much data as possible, without being threatening to the point of encumbering the interview (as is the case with video recorders) (Cohen \textit{et al.} 2005:281).

\textsuperscript{15} The aforementioned interviews were useful for conducting preliminary and closing primary research, but due to time restrictions, the feedback forms were introduced as a means of streamlining the feedback process during the design iterations.
Semi-structured questions were also included, whereby a number of questions and statements were posed, and participants were required to answer in a way they found most suitable (Cohen et al. 2005:248). The design of the feedback forms started by clarifying their purpose and aims, whereafter the subsidiary topics were identified and specific questions were formulated to address these topics (Cohen et al. 2005:246). The questions that were posed were a combination of dichotomous\(^{16}\) (where only one of two answers is possible), multiple choice, rating scale\(^{17}\), and open-ended questions. The first three options dictated specific, closed answers\(^{18}\), and the last required an open answer, which allowed participants more freedom in their responses (Cohen et al. 2005:248). The closed questions allowed for easy analysis, but ran the risk of not posing suitable or exhaustive responses (Oppenheim, cited by Cohen et al. 2005:248), and while open questions did not limit responses, they were more difficult to analyse (Cohen et al. 2005:248). Rating scales allowed a reasonable compromise between the two, as they “afford the researcher the freedom to fuse measurement with opinion” (Cohen et al. 2005:253). By including a range of question types, the researcher was able to draw on all the advantages.

In order to generate the most valid and reliable data, the questions that were posed had to be duly considered. Questions could not be leading, highbrow, complex, irritating or redundant; the wording had to be clear and unambiguous; instructions had to be clear and specific; and the visual design and layout of the document also had to be simple, attractive and interesting\(^{19}\) (see Appendix I for examples) (Cohen et al. 2005:248–251,258,260).

As mentioned before, the questionnaires could be completed without the researcher being present. As such, responses were captured in written form on the questionnaire document. Closed questions were answered by circling words or options, ticking boxes, or indicating responses on rating scales, and open questions were answered by completing sentences or by filling in a response on the provided lines\(^{20}\).

\(^{16}\) Dichotomous questions generate nominal data (Cohen et al. 2005:250).

\(^{17}\) The multiple choice and rating scale (more focused on determining degrees of preference or prioritisation) questions allowed the researcher to funnel the range of responses, provided the categories were both discrete and exhaustive (Cohen et al. 2005:251). Rating scales are particularly useful for determining the “attitudes, perceptions and opinions” of participants (Cohen et al. 2005:255).

\(^{18}\) In nearly all cases of closed questions an option had to be included that either allowed the participant to respond differently (‘Other. Please state.’) or not at all (‘Prefer not to say’ or ‘Not applicable’ or ‘Unsure’) (Cohen et al. 2005:254).

\(^{19}\) Although the small sample size allowed for the inclusion of more open-ended questions, too many of these (which are by nature more time consuming), along with complex instructions or an extensive document were also likely to irritate and discourage the participants (Cohen et al. 2005:247–249,256,258).

\(^{20}\) In certain cases, a questionnaire can also lend itself to be conducted as a structured interview instead (Cohen et al. 2005:261). When further clarification was sought through impromptu unstructured interviews, the data was captured through jottings by the researcher on the original questionnaire document, or on additional field research notes.
3.5.1.3 Observations

The third method of data collection was observation. Although the teachers / facilitators were required to observe the product in use in their classes, these observations were recorded on the feedback forms, as discussed above, and as such did not fall under the scope of this section. This section on observation refers exclusively to the situations where the researcher acted as the observer, as was the case in Phase 7. Observational data is a rich source of information, as the researcher has the opportunity to gather first-hand data in situ (Cohen et al. 2005:305). There are, however, a number of concerns related to observational studies. Some of these include that: the researcher may misinterpret observations; observations may be subjective, biased or non-generalizable; comparison is compromised due to the specificity of observations and the lack of control over variables; and there are concerns regarding the reliability and validity of gathered data (Cohen et al. 2005:313–315).

The decision to conduct observations allowed the researcher to evaluate the context, environment and product in use from her own point of view, and to note aspects that might have been overlooked or omitted by an involved party (as was a risk with the feedback forms) (Cohen et al. 2005:305). Observational data also contributed to the study’s ‘thick description’, as it recorded verbal and non-verbal communication, timing of events, typical behaviour, and contextual data, some of which was likely missed by the teachers / facilitators while interacting with their classes (Carspecken, cited by Cohen et al. 2005:311). For this study, the researcher acted as a passive, detached observer and did not participate in the interactions at all. This study only allowed for 11 instances of observation. This was sufficient to reach theoretical saturation, since the observed situations started repeating data that had already been collected.

Observational research is unpredictable, but this does not mean that the researcher cannot prepare accordingly, nor that observational sessions are unstructured. This study used a semi-structured observation approach where certain elements and factors were specifically intended for observation, but additional, undeterminable information could still be noted and gathered. Hereby, that which was taking place was merely observed and noted, and the significance that this bore on the study was decided upon later (Cohen et al. 2005:305). This method of observation did not aim to prove or refute any expectations, but aimed to gather information that could be analysed and reflected upon (Cohen et al. 2005:305).

Classrooms are data-rich environments, and care had to be taken to sift out information that was not pertinent to the study. As such, the design of the observation instances was primarily guided with the intention of gathering information related to the use of the design intervention. As with the interviews, the descriptive research was determined by data gathered regarding the physical environment, the human environment (class organisation, student demographics), interactions
(amongst students, between students and teachers, and between users and product), and the contextual environment (access to resources, style of teaching, content). The descriptive research was supplemented with an observation schedule that prompted the frequency and nature of product interactions, and the unstructured observation element contributed to exploratory research, which was aided by guidelines regarding potential difficulties, or misunderstandings, as well as the recording of unanticipated behaviour and critical incidents that fell within the scope of this study (Cohen et al. 2005:305–306,310).

The observation of the participants was conducted in person and was overt (participants knew they were being observed) and non-interventionist, however, the observer effects need to be noted. It is very possible that the presence of the researcher – in spite of being passive, unobtrusive and non-intrusive – may have influenced the behaviour of the participants (referred to as the Hawthorne effect) (Cohen et al. 2005:315). This was a calculated risk, as the ethical concern of covert observation was outweighed by the demand for data capturing. The observations were, however, not recorded on audio or video devices, as this ran a much higher risk of influencing participant behaviour, and there were greater ethical concerns at play due to the involvement of children. Instead, observations were recorded through written field notes, which included jottings by the researcher, transcriptions of conversations and interactions, and descriptions of settings, activities and behaviour (Cohen et al. 2005:311). In addition to the notes made in situ, the following were also recorded: elaboration notes made following initial observation, reflections regarding observations, points of clarification that were needed, and ongoing notes on analysis and interpretations (Cohen et al. 2005:313).

3.5.2 DESCRIPTION OF THE SAMPLE

The following section discusses the sample that participated in this study. The sample was divided into three groups: key informants (experts), secondary users (facilitators), and primary users (single learners and learner groups). The number of participants that were chosen for this study was determined by “as many people as necessary in order to gain the information sought”, and was guided by the purpose of the primary data collection (Kvale, cited by Cohen et al. 2005:278). The number of data collection incidents was similarly driven by the number of design iterations that were necessary to develop, refine and finalise the product.

The purpose of the preliminary interviews was to gather in-depth, expert information from key informants and facilitators that would aid in addressing the research gap and understanding the

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21 Based on guidelines provided by Morrison (cited by Cohen et al. 2005:305).
22 Photographic recordings, when needed, were captured after the formal observation instances, and excluded or obscured any features that would impede on the confidentiality and anonymity of the participants.
research problem. This intention lent itself to using a small sample size. All subsequent primary research was intended to provide feedback regarding the development of the design intervention and the efficacy of the proposed product which was gathered from the aforementioned key informants and facilitators, as well the single learners and learner groups. The sample size was also influenced by time scope and what was feasible for this study (Cohen et al. 2005:93). Even though the researcher and the participants collaborated in order to develop a suitable design intervention, at no point were the participants directly involved in the design process (Hayman & Popplewell 2012:1). Appendix F elaborates on the various participants according to the sample groups within which they fell. In addition to this, a summary of the field research that was conducted can be seen in Table 223.

<table>
<thead>
<tr>
<th>Phase 3</th>
<th>Phase 6</th>
<th>Phase 7</th>
</tr>
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<tbody>
<tr>
<td>Research</td>
<td>Conceptualisation</td>
<td>Development</td>
</tr>
<tr>
<td>June – July 2017</td>
<td>August 2017</td>
<td>October 2017</td>
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<th>Physical Models for User Feedback</th>
<th>Block Models</th>
<th>Prototype Samples</th>
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</thead>
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<tr>
<td>Expert 1</td>
<td>Interview 1</td>
<td>–</td>
</tr>
<tr>
<td>Expert 2</td>
<td>Interview 1</td>
<td>Feedback Form 1</td>
</tr>
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<td>Feedback Form 1</td>
</tr>
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<td>Feedback Form 1</td>
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</tr>
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</tr>
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<td>Feedback Form 1</td>
</tr>
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<td>–</td>
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<tr>
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<td>–</td>
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<td>Single Learner 2-V2a</td>
<td>Observation Notations</td>
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</tr>
<tr>
<td>Single Learner 2-V2b</td>
<td>Observation Notations</td>
<td></td>
</tr>
<tr>
<td>Single Learner 2-E2</td>
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<td></td>
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<tr>
<td>Learner Group 3</td>
<td>Observation Notations</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Overview of field work, according to sample group, data collection method and design process phase. (Table by author 2017)

23 A more comprehensive table of the field research that was conducted can be found in Chapter 4.
3.5.3 **DESCRIPTION OF THE DATA ANALYSIS**

The following section discusses topics that relate to data analysis as they pertain to this study. As mentioned before, direct interaction with participants (through the interviews, feedback forms and observations mentioned before) provided the researcher with the opportunity to understand a more realistic worldview that could not be uncovered through secondary research (Labaree 2015). By looking into individual, subjective motivations, the researcher was able to gain insight into the research problem and proposed intervention, and analysis hereof uncovered prevalent trends in thought and opinion (Labaree 2015). The understanding and analysis of these individual views also made the researcher a subjective and empathetic participant in the research (Macleod 2009).

The collected data needed to be viewed from a holistic perspective (thus understood as a complex system), to recognise contextual sensitivity (especially regarding the generalising and transferring of findings), and to acknowledge the voice and perspective of the researcher without compromising the study’s credibility (Labaree 2015). As such, this section discusses the consolidation and analysis of data, the data interpretation by means of triangulation, the validity and reliability of findings in terms of the data collection methods that were used, and the transferability of the research outcomes. This section provides an overview of these topics, while the findings themselves and the subsequent analysis and interpretation are reported in Chapter 4.

**3.5.3.1 DATA CONSOLIDATION AND ANALYSIS**

Once the participants’ responses and the researcher’s observations had been captured, the findings of each interview, questionnaire and observation were first summarised, then broken down into central ideas, and then tabulated for ease of reference. As mentioned before, the design and structure of the interview questions, feedback forms and observation notes encouraged suitable responses which aided the data capturing, analysis and comparison\(^\text{24}\) (Cohen et al. 2005:73). In cases where direct comparison was not always possible, the analysis was instead based on the identification of common themes and clusters of meaning, or – in cases of complete diversification – this was seen as an opportunity for deeper understanding and a contribution to the ‘thick description’ (Cohen et al. 2005:285).

This accounted for the analysis of primary (and secondary) research, but this study also relied on an aspect of heuristic research, whereby the subjective, yet pragmatic understanding and expertise of the researcher (and designer) had to guide the research. As Cohen et al. (2005:106) point out, the

\(^{24}\) The aggregation and comparison of participant answers did, at times, prove challenging, due to the qualitative and subjective nature of the findings, as well as the small sample size; since there were cases where the limited number of diverse, open answers meant there was little to compare (Cohen et al. 2005:256; Oppenheim, cited by Cohen et al. 2005:247).
researcher is part of the world they are researching, and as such their perspective needs to be balanced with that of the participants. Throughout the research and design processes there were both divergent and convergent phases (Cohen et al. 2005:73). The primary and secondary research – which identified the various design considerations and opportunities for addressing the research problem – were divergent, since the researcher was faced with a range of potential options and design directions (by the end of Phase 4). Through heuristic means the researcher needed to sift through and evaluate the various options, and move towards a design direction that was most suitable and realistic, thereby indicating the convergent phase, and a narrowing down of options. Each subsequent feedback phase was once again divergent, and each following design iteration was convergent, as a result of the researcher’s heuristic input (see Figure 31).

![Image of a theoretical graphical representation of the convergent and divergent research phases throughout this study.](Graph by author 2017)

3.5.3.2 Data Interpretation through Triangulation

As mentioned previously, the underlying means of analysing the qualitative data for this research was based on triangulation. Triangulation\(^{25}\) required the analysis and interpretation of the (predominantly) subjective findings from multiple sources (primary and secondary) with the intention of comparing them and having them influence, reinforce or even contrast one another (Munro 2014:55; Sagor 2000). Cohen et al. (2005:112) believe that researchers gain a better sense of

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\(^{25}\) Triangulation is one of the three approaches suggested by Lincoln and Guba (cited by Cohen et al. 2005:108) to ensure credibility in a qualitative study (alongside lengthy and sustained field research and persistent observation). Despite the name, triangulation can refer to two, three, or even more, sources of information or methods of data collection to corroborate and verify facts (Munro 2014:54; Cohen et al. 2005:112,114).
assurance in their results when these sources or methods contrast with one another, yet provide complementary findings. Although primary and secondary research comparison is one means of triangulation, the use of more than one participant per sample group in the research setting also qualifies as triangulation (Silverman, cited by Cohen et al. 2005:114). Cohen et al. (2005:115) notably state that triangulation is particularly suitable when “a more holistic view” is sought, as was the case in this study.

### 3.5.3.3 Validity and Reliability of Data

Although data analysis is a topic in its own right, so is the validity and reliability of data, especially with regard to educational research (Cohen et al. 2005:106). The validity and reliability of data is generally based on the generalisability, replicability and controllability of a study; however, Maxwell, alongside Guba and Lincoln (both cited by Cohen et al. 2005:106), argue that qualitative research should be given merit based on its authenticity, rather than outright validity, as they believe the notion of validity falls within the quantitative paradigm. Hammersley (cited by Cohen et al. 2005:107) also has an alternative view and suggests that a researcher’s confidence in their own results should be an acceptable declaration of validity.

This being said, a number of measures were taken to optimise the validity and reliability of the findings produced throughout this study. First and foremost, the study had to recognise that all gathered data was context bound, and alongside this, realise that since the researcher forms “part of the researched world”, objectivity was not guaranteed (Cohen et al. 2005:106). Furthermore, when analysing data, the researcher needed to avoid using selective or misrepresentative data; needed to disclose the context of the research situation in case this affected the data; needed to ensure all claims could be substantiated by data; and needed to ensure that data was interpreted accurately and holistically, and that this represented the views of the participants, not of the researcher (Cohen et al. 2005:106, 116–117).

In order to avoid invalidity and bias while conducting interviews, the researcher needed to: monitor both their own characteristics (attitudes, expectations and opinions) and those of the participant; take heed of the content of their questions; minimise participants’ reactivity to interview situations; and probe participants for clarification of their answers if needed (Cohen et al. 2005:116, 120). The risks to validity and reliability of the feedback form data differed somewhat from typical questionnaires, as the feedback forms were not completed anonymously (Cohen et al. 2005:128). Although the presence of the researcher can influence the validity and reliability of data, the absence of the researcher also came with the risk of the feedback forms being misunderstood, or misinterpreted (if the instructions were not clear), and furthermore, this method of data collection did not allow for the easy identification of dishonesty, inaccuracy or falsification (Cohen et al. 2005:128–129). In order to ensure validity and reliability of observational data, the researcher needed to
disclose their sampling techniques and the representativeness of these, as well as the events that were observed (Cohen et al. 2005:129). The risk with conducting observations were that the data might be skewed if: the researcher was not privy to events preceding what they were observing; the participants were unfairly representative of the sample; the researcher’s presence influenced participant behaviour; or if the researcher became attached to, or involved with, the participating group (Cohen et al. 2005:129). In the cases of all three data collection methods, invalidity and bias were minimised through the triangulation of both sources and data collection methods.

3.5.3.4 TRANSFERABILITY OF FINDINGS

As previously mentioned, the findings of action research studies cannot necessarily be generalised, but they have the potential to be transferred, provided the typicality of factors and variables are disclosed (Cohen et al. 2005:109). When transferring findings, the research outcome of a study can be hypothetically applied from one context to another (Dudovskiy 2016; Munro 2014:52). However, in order to do this, a ‘thick description’ is paramount, and the reported findings need to be “clear, detailed and in-depth” in order to allow others to assess the extent of suitable transferability (Cohen et al. 2005:109).

3.5.4 DETAILED DESCRIPTION OF FIELD RESEARCH

The previous three sections provided a general description of the data collection methods, the sample group and the data analysis as they relate to this study. This section provides a detailed report of the field research that was conducted during Phases 3, 6, and 7, with reference to these three topics, and provides an overview of the contact between the researcher and participants, the formulation of interview questions and feedback forms, and elaborates on any anomalies or difficulties that were faced while conducting the primary research.

3.5.4.1 FIELD RESEARCH CONDUCTED DURING PHASE 3

Phase 3 indicated the preliminary primary research phase. During this phase, all interviews were conducted in person and the data was collected via audio recordings (transcripts of which can be found in Appendix J) and notes, and photographs were taken when needed, provided consent had been granted. The design of the interviews started by formulating the theme and purpose of the various interviews, depending on the expertise of the respective participant, whereafter the interview questions were formulated in such a way that the questions adequately reflected the information that was sought (Kvale cited by Cohen et al. 2005:274). Hereafter, the interviews were conducted (during June and July 2017), and the audio recordings were transcribed into written text.

26 The EF, VF and TF groups, as well as each key informant (E1, E2, and E3), had a slightly different set of interview questions, as their expertise varied.
As Cohen et al. (2005:247) state, the nature of the questions was determined by the sample size, and as the sample size for this research was small, questions were less structured and more open. Each interview started with ascertaining the required demographic information, which was followed by open-ended questions in order to explore the research problem and design requirements through the participants’ perspectives.

An overview of the preliminary primary research phase is given in Table 3. The various participants, their designated codes, a description, and the dates on which first contact was made and the interviews took place are indicated. The table also indicates the means of communication used to contact the participants (T = telephonic, E = electronic, P = in-person). Exemplars of all cover letters and interview questions can be found in Appendix G and Appendix I. The declarations of informed consent can be found in Appendix H. Although the majority of participants consented to having their names used in the study, participants are referred to by their designated codes for ease of reference.

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Description</th>
<th>1st Contact</th>
<th>Introduction</th>
<th>1st: Interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1</td>
<td>Anonymous</td>
<td>Educational psychologist</td>
<td>23-Jun T</td>
<td>30-Jun P</td>
<td>30-Jun P</td>
</tr>
<tr>
<td>E2</td>
<td>Pauline Prinsloo</td>
<td>Speech and language pathologist</td>
<td>03-Jul T</td>
<td>17-Aug P</td>
<td>17-Aug P</td>
</tr>
<tr>
<td>E3</td>
<td>Sarah Ohlson de Fine</td>
<td>Founder of Learning Tools</td>
<td>19-Jun P</td>
<td>21-Jun P</td>
<td>21-Jun P</td>
</tr>
<tr>
<td>H1-1</td>
<td>Anonymous</td>
<td>Academic manager of S1</td>
<td>29-Jun P</td>
<td>07-Jul P</td>
<td>n/a</td>
</tr>
<tr>
<td>H1-2</td>
<td>Anonymous</td>
<td>Principal of S1</td>
<td>29-Jun P</td>
<td>23-Aug P</td>
<td>23-Aug P</td>
</tr>
<tr>
<td>H2</td>
<td>Mandy Bailey</td>
<td>Principal of S2: Salvazione Christian School</td>
<td>29-Jun P</td>
<td>29-Jun P</td>
<td>29-Jun P</td>
</tr>
<tr>
<td>H3</td>
<td>Gillian van den Top</td>
<td>Principal at S3: Nokuphila School</td>
<td>05-Jul P</td>
<td>05-Jul P</td>
<td>05-Jul P</td>
</tr>
<tr>
<td>H4</td>
<td>Megan Maynard</td>
<td>Programme coordinator at The Link Literacy Project</td>
<td>19-Jun P</td>
<td>20-Jun P</td>
<td>20-Jun P</td>
</tr>
<tr>
<td>EF1</td>
<td>Jeanne Botef</td>
<td>Centre manager at LC1</td>
<td>22-Jun P</td>
<td>22-Jun P</td>
<td>22-Jun P</td>
</tr>
<tr>
<td>EF2</td>
<td>Kim Damant</td>
<td>Centre manager at LC2</td>
<td>27-Jun E</td>
<td>27-Jun E</td>
<td>03-Jul P</td>
</tr>
<tr>
<td>EF3</td>
<td>Lorette Amm</td>
<td>Centre manager at LC3</td>
<td>23-Jun T</td>
<td>23-Jun T</td>
<td>06-Jul P</td>
</tr>
<tr>
<td>EF4</td>
<td>Megan Maynard</td>
<td>Programme coordinator at The Link Literacy Project</td>
<td>19-Jun T</td>
<td>20-Jun P</td>
<td>23-Jun P</td>
</tr>
<tr>
<td>VF1</td>
<td>Nicolle Alston</td>
<td>Volunteer at LC1</td>
<td>24-Jun P</td>
<td>24-Jun P</td>
<td>24-Jun P</td>
</tr>
<tr>
<td>VF2</td>
<td>Lynette Barnard</td>
<td>Volunteer at LC2</td>
<td>03-Jul T</td>
<td>06-Jul P</td>
<td>06-Jul P</td>
</tr>
<tr>
<td>VF3</td>
<td>Irene Wood</td>
<td>Volunteer at LC3</td>
<td>05-Jul P</td>
<td>05-Jul P</td>
<td>05-Jul P</td>
</tr>
<tr>
<td>TF1</td>
<td>Anonymous</td>
<td>Grade 1 teacher at S1</td>
<td>23-Aug P</td>
<td>28-Aug P</td>
<td>28-Aug P</td>
</tr>
<tr>
<td>TF2-1</td>
<td>Mandy Bailey</td>
<td>Principal of S2</td>
<td>29-Jun P</td>
<td>29-Jun P</td>
<td>29-Jun P</td>
</tr>
<tr>
<td>TF2-2</td>
<td>Thembalani Noube</td>
<td>Grade 3 teacher at S2</td>
<td>29-Jun P</td>
<td>29-Jun P</td>
<td>29-Jun P</td>
</tr>
<tr>
<td>TF3</td>
<td>Mabel Sikhakhane</td>
<td>Grade 2 teacher at S3</td>
<td>05-Jul P</td>
<td>05-Jul P</td>
<td>05-Jul P</td>
</tr>
</tbody>
</table>

Table 3: Overview of field work conducted during Phase 3.
(Table by author 2017)

The interviews that were conducted with the Group 1 participants were aimed at gathering information regarding learning challenges faced by FP learners, design requirements regarding both children and additional language acquisition, learning through play, and the psychology of learning. The researcher first identified the key participants based on pertinent expertise and convenience (in terms of accessibility and availability), whereafter initial contact was made with the participants and interviews were arranged according to times and locations that suited the participants (Cohen et al. 2005:104).
The interviews that were conducted with the Group 2 participants were aimed at gathering information related to facilitating the learning of an additional language, typical learning difficulties, UCD requirements, and the practicality and suitability of support products. The researcher first approached the co-ordinator of The Link Literacy Project, Megan Maynard (H4), to discuss the research study, at which point Maynard granted consent for the study to be conducted at various centres operated by The Link. Upon further discussion, Maynard identified three centres at schools that were most suitable for the study. Maynard introduced the respective centre managers (Expert Facilitators – EFs), who in turn facilitated the introduction to the volunteers (Volunteer Facilitators – VFs). The centre managers also introduced the researcher to the principals (Heads – Hs) of the respective schools, and – once consent had been granted – the principals subsequently facilitated the introductions to the FP teachers (Typical Facilitators – TF). This resulted in a sample that was satisfactory to the study’s specific needs of addressing the research gap and expanding the understanding of the research problem (Cohen et al. 2005:103). EFs, VFs, Hs and TFs were met at times and locations suitable to them, and the researcher took care not to be intrusive, or to inconvenience any participants. H1-1 requested that S1 not be identified, and subsequently C1, H1-2 and TF1 were also encoded.

It must be reiterated that the researcher undertook no observations of the learners per se during this phase, as this posed the risk of misinterpreting classroom or teaching difficulties, since this is not the researcher’s field of expertise. However, on two instances, when arranging to meet with the EFs, the researcher was invited to attend and observe The Link’s literacy sessions. To avoid infringing on ethical boundaries, the researcher did not actively observe the learners and facilitators, but took the opportunity to familiarise herself with the support resources that are used by The Link. The researcher was granted consent to photograph the resources, and these have been used where deemed necessary.

3.5.4.2 Field Research Conducted During Phase 6

Phase 6 indicated the first design iteration which was based on design conceptualisation. Upon finalisation of four design directions, the researcher composed a questionnaire-style feedback from (see Appendix I) that was used to ascertain the study participants’ opinions on the various design concepts. Participants were approached with feedback forms that provided descriptions and depicted visual renderings of the product concepts (4.7.3), as well as physical block models of the concepts (4.7.4). An online version of the questionnaire was developed to accommodate participants who were unable to meet with the researcher during the designated time frame (see Appendix I). Of the 14 participants who were involved in the preliminary primary research, 11 participants were seen in person, two participants (EF3 and TF3) opted to complete the online version of the questionnaire, and one participant (E1) was unable to partake in this phase of the research. An overview of the primary research conducted during this phase is indicated in Table 4.
The approach to the in-person and the online questionnaires did differ. By meeting with the participants in person, the researcher was able to answer any questions the participants had, and was able to ensure that each participant had the same understanding of the various concepts. As with the wording of the questions in the interview, the standardisation of the descriptions did not rely on “replicating exact wording”, but ensured that all participants had the same understanding of the concepts (Oppenheim, cited by Cohen et al. 2005:270). The standardisation of the descriptions in the online survey was easier to achieve, however, this came at the compromise of the participants potentially not fully understanding the concept (due to not being able to ask questions, and not being able to interact with the block models) and the researcher not being able to probe the participants for further information or explanations. This was taken into account during the subsequent data analysis. Although the feedback forms could be completed without the presence of the researcher, her presence did allow participants to ask clarification questions, as mentioned before, and incidentally led to discussions regarding the further development of the various concepts. These were captured as field notes, and have been tabulated accordingly in Appendix J.

The feedback forms were divided into three sections: the first asked two question regarding design considerations in general; the second provided participants with descriptions and visual renderings. As can be seen in the renderings of the concepts (provided in Section 4.7.3), no content was represented on the dice, tiles, tokens or blocks. These were intentionally left blank, so as not to unduly influence the participants on the basis of content that was depicted.
of each concept, and asked participants to assess the product according to certain criteria; and the third required participants to select the concept they believed would be most successful and beneficial to support language development, and asked a few concluding questions based on their concept selection. The feedback was specifically focused on product usability and functionality, from both learners’ and facilitators’ perspectives, as well as adaptability of use in various learning contexts and environments. It was reiterated to the participants that their feedback would be used to determine the best concept direction, and that the final product would still undergo further development.

By predominantly relying on rating scales, multiple choice questions, and dichotomous questions, the data analysis process was streamlined, however, the inclusion of a few open questions and requests for further elaboration on some answers allowed the researcher to gather more in-depth and descriptive information. The use of rating scales (which focused on determining degrees of preference or prioritisation) was particularly beneficial as they assisted in determining the “attitudes, perceptions and opinions” of participants, and they “[afforded] the researcher the freedom to fuse measurement with opinion” (Cohen et al. 2005:253,255). It is important to note that even though the data analysis relied on a certain level of quantification, the data was still considered qualitative (as it was based on participants’ opinions) and assigning numerical values to their answers was deemed the best strategy for accurately and fairly evaluating the findings.

The only problem that was faced during this phase of participant feedback was that some of the rating scale answers were left blank by some participants. It was unclear whether or not this was intentional or accidental. In these cases, the participant’s answer was simply excluded from the calculations during the data analysis.

As with the previous phase, the researcher undertook no observations of the learners during this phase, and all feedback was directed at secondary users (facilitators). In addition to the researcher not wanting to risk insufficient explanations of the various concepts to the learners, and misinterpretation of learner responses, the researcher thought it likely that learners would be prone to choosing a concept according to entertainment value and not according to educational value as facilitators were more inclined to do.

3.5.4.3 Field Research Conducted During Phase 7

Phase 7 indicated the second design iteration which was based on design development. Although this was not the final design iteration, this was the last phase to include active participant feedback. The user feedback that was collected during this phase was conducted in two stages in order to streamline the data collection process. Upon finalisation of the developed product, the researcher composed a new questionnaire-style feedback from (see Appendix I) that was used to ascertain the
participants’ opinions on the developed product prior to conducting any field testing. The feedback forms provided an overview and visual renderings of the product, storage system, and suggestions for game-play (4.8.3). Instead of approaching any participants to complete the forms under guidance of the researcher, the forms were developed on an online platform and distributed to participants via email. Of the 14 participants who were involved in the preliminary primary research, 13 participants completed the online feedback form. E1 did not respond.

Once participants were familiar with the product, storage system, and intended game-play (through reading and answering the online feedback form), the researcher arranged to meet with various participants (facilitators only, not key informants) to capture their responses to the physical product. Unfortunately, time and budget constraints only allowed for a sample selection of blocks to be presented to participants, and the storage system was not presented at all. Participants were first requested to interact with the prototype samples themselves, and were encouraged to ask any questions that might have arisen during their answering of the online forms. Participants were then requested to use the product to support the facilitation of their session or class with a learner or learner group. In both cases, participants were asked to complete an additional feedback form (see Appendix I). Of the 11 participants who were included in this stage of the primary research, five interacted with the product without facilitating learning (EF1, EF4, VF1, TF1, TF2-2), and six interacted with the product and did facilitate learning by using the product (EF2, EF3, VF2, VF3, TF2-1, TF3). An overview of the primary research conducted during this phase is indicated in Table 5.

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Description</th>
<th>3rd: F-Form</th>
<th>4th: Interaction &amp; Observation</th>
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<tbody>
<tr>
<td>Group 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E1</td>
<td>Anonymous</td>
<td>Educational psychologist</td>
<td>–</td>
<td>n/a</td>
</tr>
<tr>
<td>E2</td>
<td>Pauline Prinsloo</td>
<td>Speech and language pathologist</td>
<td>16-Oct P</td>
<td></td>
</tr>
<tr>
<td>E3</td>
<td>Sarah Ohlson de Fine</td>
<td>Founder of Learning Tools</td>
<td>09-Oct E</td>
<td></td>
</tr>
<tr>
<td>EF1</td>
<td>Jeanne Botef</td>
<td>Centre manager at LC1</td>
<td>09-Oct E</td>
<td>12-Oct P</td>
</tr>
<tr>
<td>EF2</td>
<td>Kim Damant</td>
<td>Centre manager at LC2</td>
<td>12-Oct P</td>
<td>18-Oct P</td>
</tr>
<tr>
<td>EF3</td>
<td>Lorette Amm</td>
<td>Centre manager at LC3</td>
<td>09-Oct E</td>
<td>16-Oct P</td>
</tr>
<tr>
<td>EF4</td>
<td>Megan Maynard</td>
<td>Programme coordinator at The Link Literacy Project</td>
<td>14-Oct E</td>
<td>12-Oct P</td>
</tr>
<tr>
<td>Group 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VF1</td>
<td>Nicole Allison</td>
<td>Volunteer at LC1</td>
<td>09-Oct E</td>
<td>17-Oct P</td>
</tr>
<tr>
<td>VF2</td>
<td>Lynette Barnard</td>
<td>Volunteer at LC2</td>
<td>09-Oct E</td>
<td>18-Oct P</td>
</tr>
<tr>
<td>VF3</td>
<td>Irene Wood</td>
<td>Volunteer at LC3</td>
<td>09-Oct E</td>
<td>16-Oct P</td>
</tr>
<tr>
<td>TF1</td>
<td>Anonymous</td>
<td>Grade 1 teacher at S1</td>
<td>09-Oct E</td>
<td>16-Oct P</td>
</tr>
<tr>
<td>TF2-1</td>
<td>Mandy Bailey</td>
<td>Principal of S2</td>
<td>12-Oct E</td>
<td>18-Oct P</td>
</tr>
<tr>
<td>TF2-2</td>
<td>Thembelani Ncube</td>
<td>Grade 3 teacher at S2</td>
<td>09-Oct E</td>
<td>18-Oct P</td>
</tr>
<tr>
<td>TF3</td>
<td>Mabel Sikhakhane</td>
<td>Grade 2 teacher at S3</td>
<td>10-Oct E</td>
<td>16-Oct P</td>
</tr>
</tbody>
</table>
Table 5: Overview of field work conducted during Phase 7.  
(Table by author 2017)

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>n/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>SL2-V1</td>
<td>–</td>
<td>Single learner from LC2 – Grade 2</td>
<td>18-Oct P</td>
</tr>
<tr>
<td>SL2-E1</td>
<td>–</td>
<td>Single learner from LC2 – Grade 2</td>
<td>18-Oct P</td>
</tr>
<tr>
<td>SL2-V2a</td>
<td>–</td>
<td>Single learner from LC2 – Grade 3</td>
<td>18-Oct P</td>
</tr>
<tr>
<td>SL2-V2b</td>
<td>–</td>
<td>Single learner from LC2 – Grade 3</td>
<td>18-Oct P</td>
</tr>
<tr>
<td>SL2-E2</td>
<td>–</td>
<td>Single learner from LC2 – Grade 3</td>
<td>18-Oct P</td>
</tr>
<tr>
<td>LG2-1</td>
<td>–</td>
<td>Learner Group from S2 – Grade 3 – four learners</td>
<td>18-Oct P</td>
</tr>
<tr>
<td>LG2-2</td>
<td>–</td>
<td>Learner Group from S2 – Grade 1 – four learners</td>
<td>18-Oct P</td>
</tr>
<tr>
<td>SL3-V1a</td>
<td>–</td>
<td>Single learner from LC3 – Grade 2</td>
<td>16-Oct P</td>
</tr>
<tr>
<td>SL3-V1b</td>
<td>–</td>
<td>Single learner from LC3 – Grade 2</td>
<td>16-Oct P</td>
</tr>
<tr>
<td>SL3-E1a</td>
<td>–</td>
<td>Single learner from LC3 – Grade 2</td>
<td>16-Oct P</td>
</tr>
<tr>
<td>SL3-E1b</td>
<td>–</td>
<td>Single learner from LC3 – Grade 2</td>
<td>16-Oct P</td>
</tr>
<tr>
<td>SL3-V2a</td>
<td>–</td>
<td>Single learner from LC3 – Grade 3</td>
<td>16-Oct P</td>
</tr>
<tr>
<td>SL3-V2b</td>
<td>–</td>
<td>Single learner from LC3 – Grade 3</td>
<td>16-Oct P</td>
</tr>
<tr>
<td>SL3-E2a</td>
<td>–</td>
<td>Single learner from LC3 – Grade 3</td>
<td>16-Oct P</td>
</tr>
<tr>
<td>SL3-E2b</td>
<td>–</td>
<td>Single learner from LC3 – Grade 3</td>
<td>16-Oct P</td>
</tr>
<tr>
<td>LG3</td>
<td>–</td>
<td>Learner Group from S3 – Grade 2 – 20 learners</td>
<td>16-Oct P</td>
</tr>
</tbody>
</table>

The online feedback forms (see Appendix I) that were presented to participants were divided into three sections. The first section provided a detailed description of the product that had been developed based on feedback from the previous design iteration. The feedback forms provided a description and visual renderings of the components and the content, the storage of the product, and suggestions for how to use the product. At the end of each description, a dialogue box was included in which participants could jot down any immediate thoughts they had and participants were asked to rate their response to the product based on what had been described. The second section asked participants to assess the product according to certain criteria based on their understanding of the product; and the third section posed a few open-ended questions that asked participants their broad opinion regarding the product. This feedback focused on product usability, and the evaluation of various aspects of the product from secondary users’ perspectives. Although relying on online feedback limited the participants’ opportunity to ask clarifying questions and restricted the researcher’s ability to ask for additional information, the online platform did allow for standardisation of descriptions and understanding, and the optional dialogue boxes provided the opportunity to comment throughout the product explanation. It is likely that some participants would have been more willing to provide verbal feedback than written feedback, but the online platform ‘forced’ participants to distil their feedback into what they believed was most important.

Prior to approaching participants (facilitators, not key informants) to request their interaction with the prototype samples and use of the products during their classes or sessions, the researcher contacted
the respective heads of the schools and organisation telephonically to request their consent to test the product in the educational environments. Due to the nature of the study, and the schools and organisation not being affiliated with government departments, all three heads (H2, H3 and H4) indicated that it was not necessary to request parental consent, nor learner assent, in order for the learners to interact with the products. Furthermore, the heads and the centre managers (H2, H3, H4, EF2 and EF3) also granted consent for the researcher to unobtrusively observe and photograph the learners while the product was in use. Once again, parental consent and learner assent were not required.

Once consent had been granted, the researcher met with the participants to demonstrate the product to them. As mentioned before, some participants were only able to interact with the product themselves, and did not facilitate any learning by using the product (EF1, EF4, VF1, TF1, TF2-2). These participants were only required to complete the first section of the additional feedback form. This section was intended to electronically ascertain participants’ impressions of the product that was presented to them subsequent to having seen and interacted with the prototype samples. The remainder of the participants were, however, willing and able to use the product to support the facilitation of their classes or sessions subsequent to having interacted with the products themselves (EF2, EF3, VF2, VF3, TF2-1, TF3). These participants were also required to complete the second section of the feedback form which aimed to gauge participant and learner responses to interaction with, and use of, the product. This feedback focused on product functionality, and the evaluation of various aspects of the product from primary users’ perspectives, as witnessed by secondary users.

The researcher was granted consent to observe the learners’ interaction with the product while participants were conducting their sessions or classes with the support of the product. Although the feedback from learners was predominantly gathered through the questions that were presented to the facilitators, the researcher took note of any pertinent comments, actions or responses from both facilitators and learners. The researcher’s reasoning for not directly interacting with learners is twofold. The first is that since young children battle to articulate their thoughts and feelings it can be very difficult to get accurate feedback regarding their needs and preferences, which is why observations alone, without verbal feedback, proves useful in feedback situations (Lueder & Rice 2008d:403; Cohen et al. 2005:126). Secondly, verbal feedback (after observation) from people who are more familiar with how children express their requirements proves more valuable and reliable. Interviewing children poses a number of logistical and ethical problems, and the reliability of these findings is highly questionable (Cohen et al. 2005:125); especially since children can confuse needs

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28 As is explained in Section 4.9.1, TF1 was not willing to test the prototype in her class. As such, she was asked to provide feedback on her own experience with the product, but she was not asked to facilitate learning with the support of the product, and thus H1-1 and H1-2 were not contacted.
and wants, and easily fall victim to peer pressure (Lueder & Rice 2008d:403). Due to the researcher’s limited experience in dealing with children in an educational environment, the researcher did not attempt to analyse any learner behaviour or responses beyond what was presented at face value.

As with the feedback form used in the previous phase, the use of rating scales and dichotomous questions (in the forms used for both components of this research phase) streamlined the data analysis process, and the inclusion of a few open questions and requests for further elaboration allowed the opportunity for more descriptive feedback. The advantages posed by the use of rating scales (as mentioned in the previous phase) once again proved beneficial for attributing values of measurement to participant opinion. The only problem that was faced during this phase of participant feedback, is that one of the participants (TF2-1) started to complete the online survey on one device, and then restarted the survey on another device. As her weighted responses to some of the questions were inconsistent, the researcher opted to use the average weighting of the inconsistent responses. Although it may seem that the latest responses would be more accurate, the researcher feared that the participant might have been rushed to complete the second submission, and might not have considered her answers as carefully as she had done during the first, incomplete submission.

3.6 ETHICS OF RESEARCH

It is important to follow research-related ethical norms in order to uphold the “aims of research” and to ensure that researchers are held accountable (Resnik 2011). The ethics involved in educational research can be particularly complex, as researchers are required to balance their subjects’ rights (especially children) and their own academic pursuits, as the researcher has an obligation towards both (Cohen et al. 2005:49,71,316). In the case of this study, the main concerns that arose were related to the involvement of children, and the matter of consent, however, this section also touches on the topics of data collection ethics, beneficence and non-maleficence, and design-related ethics. Through all phases of the design process, it was important that the researcher did not lose sight of her obligations to “those who[m] [she] was helping”, and she was required to reconsider her techniques as and when the situation demanded (Cohen et al. 2005:58).

29 Research ethics refers to ethical norms that “serve the aims” of research and the people who conduct it (Resnik 2011). Ethical lapses can harm those involved and can be classified as scientific misconduct (Resnik 2011). It is important to identify potential ethical issues that the study might invoke in order to avoid bias and to guarantee the validity of this study and the subsequent findings.

30 Ethics need to be considered at every stage of the research process and may arise from the study itself, the context of research, the nature of the participants, the methods of data collection, or the dissemination of findings (Cohen et al. 2005:49).

31 Although it might appear that the ethical constraints created a limiting context for study, it is important to note that all considerations by the researcher were made with the intention of avoiding potential harm, and
3.6.1 THE INVOLVEMENT OF CHILDREN

The greatest cause for concern regarding ethics in this study was the involvement of children. A critical aspect regarding this was the researcher’s own beliefs, attitude and practice, since these could influence the child’s experience (ERIC 2013). In their extensive report, *Ethical Research Involving Children* (ERIC) (2013:29–92), Dr Donnah Anderson, Dr Robyn Fitzgerald, Prof Anne Graham, Dr Mary Ann Powell and Prof Nicola Taylor identify the four key areas of concern as: harms and benefits\(^{32}\), informed consent and assent (of both the parent / caregiver and the child), privacy and confidentiality (especially with regard to not being identifiable\(^{33}\) in the publication and dissemination of findings), and payment or compensation. Children are often seen as vulnerable and incapable of making informed decisions (Anderson *et al.* 2013:2,59), however, following the *International Charter for Ethical Research Involving Children*\(^{34}\) ensured that the children’s dignity and sense of competence were respected and upheld\(^{35}\). When working with groups of children, additional factors need to be considered, such as inclusiveness and avoiding discrimination, addressing the power differences between children and adults, and how a child’s opinion could be influenced in a group setting (Anderson *et al.* 2013:38–41,64; Cohen *et al.* 2005:52). The children’s safety was also of paramount importance – the researcher had to take care not to place the children in situations where they were at risk of harm, and had to ensure sufficient adult supervision at times that they were interacting with any products or materials provided by the researcher (Cohen *et al.* 2005:53; DOE 2003:66). Furthermore, it is of critical importance to note that the observation of children by the researcher was always conducted under the supervision of the facilitators.

3.6.2 CONSENT

The matter of consent was of fundamental importance, and affected the study in two different capacities, both of which are elaborated on below. These were: institutional consent, and the informed consent of participants. The researcher required permission to access the institutions or organisations, as well as acceptance by the various participants\(^{36}\) (Cohen *et al.* 2005:53).

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\(^{32}\) For example, a potential harm may be a child’s disappointment when certain expectations are not met, and a potential benefit may be learning through the research (Anderson *et al.* 2013:32,34).

\(^{33}\) This includes the use of “photographs containing images of children, other people, location landmarks and other identifying features” (Anderson *et al.* 2013:77).

\(^{34}\) According to the *International Charter for Ethical Research Involving Children* any research that is conducted must be equitable, must benefit the children, must not harm the children, must respect the children's dignity, and requires informed and on-going consent as well as constant reflection from the researcher (Anderson *et al.* 2013:23).

\(^{35}\) This also ties in with the *Convention on the Rights of a Child* (1989) which states that children have a right to have their opinions heard in matters that involve them.

\(^{36}\) Informed consent was considered granted once participants had decided to partake in the study after having been informed of all facts that could possibly influence their decisions (Diener & Crandall, cited by Cohen *et al.* 2005:51). According to Cohen *et al.* (2005:51), informed consent is also based on the participants’
3.6.2.1 **Institutional Consent**

Since the study took place at private institutions and organisations, it was not necessary to obtain consent for the study from the DBE, or the provincial education department. However, the principals and head coordinators needed to give permission for the study to be conducted in their schools or facilities. The researcher was required to approach the various institutions and organisations with an introductory letter stating the background, nature and intent of the research study, and clearly indicating the support of the university and study supervisor (Cohen *et al.* 2005:55). The institutions and organisations were guaranteed that adult participants had the opportunity to remain anonymous and that learner participants were guaranteed anonymity; that data was strictly confidential; that the institution or organisation would receive a digital copy of the final study; and that the study hoped to benefit those who partook in it (Bell, cited by Cohen *et al.* 2005:56). Only once the principals and coordinators had sanctioned the study and granted access, could the teachers and facilitators be approached.

3.6.2.2 **Informed Consent**

All adult participants' informed consent was required before conducting any interviews or distributing any feedback forms. This entailed that the research participants were made fully aware of everything that was expected of them and that they understood they had the right to withdraw from the study at any given time, since informed consent naturally infers informed refusal (Cohen *et al.* 2005:51; Polonsky & Waller 2005:70–73). Informed consent also implied that the researcher was responsible for thoroughly explaining the possible benefits and risks, involved in participating in the study, and that participants be made aware of their rights (Cohen *et al.* 2005:50). The information that was conveyed in the consent form included time constraints, study details, contact details and data recording consent (in the form of photographs, audio recordings, notes, etc. depending on the method of data collection). All interviewees had to be willing participants, and their dignity and well-being had to be respected at all times. The interviewees were made aware that even though the interviews were not necessarily anonymous, their identities would be kept confidential – unless they had given their permission to have their names used in the research dissertation (Polonsky & Waller 2005:75). The matters of confidentiality and anonymity ensured the privacy of the participants, and also extended to the matter of non-traceability (Cohen *et al.* 2005:60–62).

The participants also needed to be aware that they would not receive any remuneration for participating in the research study; neither could they claim a stake in the end results, nor in the intellectual property. Furthermore, research needed to be conducted fairly and honestly, and none of the procedures, data collection methods, or research practices could undermine the participants' competence, voluntarism and comprehension, and the disclosure of full information. All cover letters and consent forms can be found in Appendix G.

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As was typically the case when an expert in a field was used as a key informant.
of the presented research findings would be misrepresented, omitted or falsified (Munro 2014:123; Polonsky & Waller 2005:78). Feedback had to be given to adult participants regarding the outcome of the study, and they were made aware of what would happen to the data after the study. Although learners were never directly involved with research, or providing feedback (for the reasons mentioned in 3.5.2.3), they were still participants in the study, and are usually required to provide assent (as they are not of legal age) (Cohen et al. 2005:52,53). However, since the schools and organisation involved in this study are not affiliated with government departments, the heads and principals indicated that it was not necessary to request parental consent, nor learner assent, in order for the researcher to conduct product testing with the learners, or to photograph the product while in use by the learners. The heads and principals only indicated that learners should not be identifiable in the photographs, and the researcher censored all identifiable features accordingly.

3.6.3 DATA COLLECTION METHODS

There were three pertinent ethical issues that arose with regard to the three methods of data collection; these were informed consent, confidentiality, and the consequences of the research (Kvale cited by Cohen et al. 2005:292). The matters of informed consent and assent are addressed above. As a consequence of informed consent, participants could not be coerced into participating; they had the right to withdraw at any stage, and they needed a guarantee of “confidentiality, anonymity and non-traceability” (Cohen et al. 2005:245–246). As mentioned before, all data and all participants were treated with confidentiality; Group 1 participants consented to having their identities disclosed, Group 2 participants were given the opportunity to remain anonymous, and Group 3 participants (learner groups) were treated as anonymous participants, and – where possible – their identity was not even disclosed to the researcher. Further steps were taken to prohibit the traceability of anonymous participants. The dissemination of findings was also disclosed to participants and relevant institutions and organisations on the cover letters and consent documentation. In the case of this study, findings were published in this Master’s dissertation, which – as mentioned before – was made available (digitally) to the adult participants, and institutions and organisations. As a precaution, all participants and institutions also consented to the findings of this study being published in academic journals and appropriate media articles.

38 In the case of this study the findings have been made public and the participants are allowed to access the data until two years after the study has been completed.
3.6.4 BENEFICENCE AND NON-MALEFICENCE

Throughout the design of this study, the principles of beneficence (‘do good’) and non-maleficence\(^{39}\) (‘do no harm’) had to be upheld (Munro 2014:122; Cohen \textit{et al.} 2005:246). This meant that the researcher had to be cognisant of the vulnerability of the participants (in physical, emotional, psychological, economic, and cultural terms) and of the potential of detrimental invasion\(^{40}\) (into the participants “space of living or being”) or effects that the study might have had, on both adults and children (Munro 2014:125–126; Cohen \textit{et al.} 2005:56). If any participant, especially from the learner groups, exhibited signs of stress or discomfort, the researcher was obliged to put the participant’s safety and dignity ahead of the research aims (Cohen \textit{et al.} 2005:53,56). Furthermore, the scholarship principle (‘do things well’) encouraged the researcher to conduct the study to the best of her ability and to ensure that very little, in terms of time, money, and effort, was wasted (Munro 2014:122).

3.6.5 DESIGN RELATED ETHICS

Although this study incorporated a wide range of aspects, the focus needed to be predominantly on design, as this is where the interest of the researcher’s discipline lies (industrial design). The product also needed to conform to design principles and theories that would result in an ethical product, such as ergonomics, ease of use, practicality and affordability. Additionally, the non-maleficence principle is often forgotten when it comes to the environment (Munro 2014:122). The balance between ethical responsibility to the environment, and to society were also important; for example, the use of environmentally sustainable materials had to be weighed up against social ethics regarding the affordability of the product.

3.7 CONCLUSION

The research methodology chapter concludes by drawing attention to the acknowledgement that this study’s primary research yielded predominantly qualitative, subjective views and that, because of this, the findings can only be transferred, and not generalised. However, the hypothetical application of this study’s findings to similar contexts suited the design and outcome of this study, as the resultant intervention has the potential to be implemented at schools throughout the country, provided the contextual relevance persists. Furthermore, it is important to reiterate that the interpretivist approach,

\(^{39}\) The beneficence principle dictates that a study should aim to contribute to the improvement of a situation or society and that their involvement should in some way benefit the participants (for example, by learning or “contributing to the advancement of knowledge”); and the non-maleficence principle decrees that no harm shall befall those participating in the research (Munro 2014:122,127).

\(^{40}\) Questionnaires and interviews can both be an intrusion into the participant’s life, as it requires the participant to sacrifice their time, and depending on the nature of the questions, these data collection methods might appear threatening (Cohen \textit{et al.} 2005:245). In line with this, the interviews and feedback forms were specifically designed to be as efficient and non-threatening as possible.
along with heuristic research methods, allowed the researcher’s own experience and views to form part of the research that informed the design solution. However, due to the involvement of the researcher in the study, the researcher ran the risk of unintentionally biasing the research results, and subsequently rendering the study invalid (Labaree 2015). This was monitored through constant objective reflection throughout the research process, and practically argued design decisions during the product development phase. Additionally, since most of the primary data was gained from key informants and from first-hand observations, rather than anonymous participants, and because this study relied on triangulation to analyse the data, the findings are deemed reliable and valid.

In conclusion, it can be seen that the primary research described in this not only addresses the research gap identified in Section 2.6, but also contributes to guiding the development of the proposed design intervention. The descriptive research of the previous chapter is used as a basis for this intensive normative approach (primary research), which contributes to the understanding of how to improve the existing situation through the design of a product-based intervention. This primary research furthers the understanding of “how things are”, and also aids in evaluating the current situation, as is the case with the secondary research (Routio 2007 ‘How to create theory of design’). However, as identified in the conclusion of the preceding chapter, the paucity of certain secondary research presents an opportunity to conduct further exploratory research through interviews and additional primary research, in order to collect more specific data that can contribute to addressing the research problem and inform the design outcome – as is reported in the ensuing chapter, which describes the development of the design intervention.
CHAPTER 4 – PRODUCT DESIGN

4.1 INTRODUCTION TO DESIGN ITERATIONS

This chapter discusses the research findings, data analysis and product development. It draws directly from the design process, and thus discusses the study according to each phase that has been elucidated. This study went through stages of conceptualisation, development and refinement, but relied on user testing and feedback, and subsequent analysis and reflection of the findings, to support the iterative cycles.

This section commences with a brief overview of the implementation of Phases 1, 2 and 3 of the study, during which the problem was identified and the project brief was formulated (4.2), and both secondary research (4.3) and preliminary primary research were conducted (4.4). The findings of the preliminary primary research are synthesised and analysed in Section 4.5. Analysis and comparison of findings from primary and secondary sources during Phase 5 led to the development of a set of design requirements for the educational toy (4.6). The considerations for the design of the intended product are discussed according to UCD requirements, language-specific requirements, and conceptual, physical and visual design requirements. This section concludes with an overview of all the considerations which have been tabulated and arranged according to category and hierarchy.

The data from Phase 4, alongside the design requirements developed in Phase 5, fed directly into the design conceptualisation phase (Phase 6). Phase 6 is described according to design direction visualisation, concept ideation, and concept exploration, and concludes with a brief note on the user feedback that was collected during this phase (4.7). This section refers to the various product solutions as numbered concepts (Cs). The design development (4.8) which was conducted during Phase 7, commences with the analysis of, and reflection on, the user feedback from the previous phase, whereafter the design was developed accordingly, and user feedback (as well as user testing) was required once more. Here, the product intervention is referred to as the developed product (DP). Phase 8 commenced in a similar fashion to the previous phase, where the preceding user feedback was analysed and reflected upon, whereafter design refinements are suggested (4.9). This section refers to the product intervention as the refined product (RP). Phase 9 consists of a heuristic evaluation of the final design intervention (DI). The DI is evaluated according to the design requirements that were developed in Phase 5. This chapter concludes by briefly mentioning Phase 10, however, this phase covers the resolution of the study, and ultimately refers the final chapter of the dissertation.
As previously mentioned, the design process for this study started with the identification of a problem, which led to the development of a brief. The problem\(^1\) was identified and elaborated on in the problem statement (1.3). The brief for this study was subsequently derived from this problem statement, and outlined the aims and deliverables of the project, and was also used to determine the scope of the study (Boulton 2009:41). The brief reads as follows:

> Applying a user-centred design approach, design an educational toy that supports the teaching and learning of an additional language, at the Foundation Phase level. Prior to developing the product, conduct both primary and secondary research in order to: determine the framework of the study, identify the research gap, and develop an understanding of the design requirements.

> Throughout the design process, bear in mind the industrial design approach and the design of a tangible end product; the limitations of use and users; and the greater South African context. The primary intention of the product is use in the classroom or learning environment. As such, consideration for the needs of both the primary users (Foundation Phase learners) and the secondary users (learning facilitators) should be evident in the user-centred design approach. Although this product is meant for use by learners from all backgrounds, special consideration needs to be given to the needs and limitations of children from underprivileged backgrounds, as the majority of South African school children falls into this category. Keep in mind the importance of English within the South African context, but – as far as possible – the educational toy needs to focus on broad-based additional language acquisition, as this is vital to encouraging multicultural cooperation and communication.

> The product’s success will be measured by whether it is effectively used and understood by teachers and learners alike, and will be evaluated against the design requirements that are developed through analysis of the primary and secondary research findings.

\(^1\) Cohen \textit{et al}. (2005:235) caution that a ‘problem’ should rather be interpreted as a ‘need for innovation’.
This brief was supported by additional research that investigated the contextualisation and the necessity of the study (1.2). Furthermore, the scope and limitations of the project, as well as the project objectives, were delineated in Section 1.5. The development of this brief concluded the first phase of the preparation that was required before conducting any research.

4.3 **Phase 2: Secondary Research**

Secondary research involved the systematic and organised gathering of information (with a focus on users and their tasks) and was compiled and presented as a ‘Literature review’ (Chapter 2). This review provided insight into the aforementioned problem and helped the initial generation of ideas for the design solution in a ‘real-world context’ (Boulton 2009:42). The literature review specifically investigated the topics of FP education, children and learning, design requirements for children, and existing products that aid with language development. This qualitative data aided in framing the context in which the product would be used, and informed the type of toy that needed to be designed. Phase 1 identified the problem and delimited the scope of the problem, as per Routio’s (2007 ‘How to create theory of design’) theory of design. In Phase 2 objective research was done and the facts and knowledge that are considered invariable, without suggesting changes thereto, were presented. This pertained to both extensive research (knowledge regarding more general fields, such as child development and learning) and intensive research (knowledge regarding more specific fields, such as education in South Africa, and designing for children). This contributed to framing the researcher’s understanding and evaluation of the ‘present state of things’ (Routio 2007 ‘How to create theory of design’). Furthermore, as this study is ideographic, the descriptive research allowed for the evaluation of the current situation, and to investigate in which respect the product intervention can ameliorate that which has been identified as problematic (Routio 2007 ‘How to create theory of design’).

4.4 **Phase 3: Preliminary Primary Research**

The descriptive secondary research reported in the literature review was used as a basis for the initial primary research (intensive normative approach) that followed. This intensive normative approach allowed for the investigation of the “needs and goals of people [and] how to fulfil them” (Routio 2007 ‘Theory of furniture’). Where the descriptive approach of the secondary research allowed for the exploration of “how things are”, the normative approach of the primary research allowed for the inquiry as to “how things should be” (Routio 2007 ‘How to create theory of design’). By conducting interviews with the participants, the researcher was able to further investigate the research problem, address the research gap, and develop a deeper understanding of how to improve the ‘existing situation’ through the design of a product-based intervention. The qualitative data that was gathered from the initial primary research was based on the opinions and knowledge of experts,
facilitators and teachers who were interviewed, and a detailed report of the research that was conducted during this phase can be found in Section 3.5.4.1.

4.5 PHASE 4: FINDINGS AND DATA ANALYSIS

The second stage of the design process commenced in Phase 4 when various iterations and cycles occurred, and where the phases of product development ensued. However, prior to the commencement of any design, the findings from the interviews described in the previous section were evaluated, synthesised and analysed. This information was analysed by identifying similarities and discrepancies between participant responses, with the intention of comparing them and having them influence, reinforce or even contrast one another (as explained in Section 3.2.1 with reference to Munro (2014:55) and Sagor (2000)). Although a small sample size was preferential for gaining a thorough understanding of the research problem and research gap, it did at times prove challenging to make direct comparisons or differentiations between participant responses. The researcher was, however, able to identify a number of common themes which influenced the design direction of the product. Although the data analysis predominantly relied on triangulation between participant responses, there were a number of occasions where salient points from single participants were used in isolation or corroborated with secondary research in order to contribute to the ‘thick description’. The process of data analysis also drew from heuristic reflection and deductions, and cited secondary research from the literature review where pertinent.

This phase further allowed for the evaluation of the ‘present state of things’ through the primary research (Routio 2007 ‘How to create theory of design’) and the direct interaction with participants provided the researcher with the opportunity to understand a more realistic worldview that could not be uncovered through secondary research (Labaree 2015). The findings are discussed according to the following topics: barriers to learning in South Africa in terms of an overarching problem and the resultant learning difficulties; language acquisition as facilitated in the classroom and through one-on-one teaching; support resources that are being used and that are needed; and insight into design considerations for an educational toy. The data in this section references the interview transcripts that can be found in Appendix J.

4.5.1 CONFIRMING THE LEARNING DIFFICULTIES IN SOUTH AFRICA

In order to gain a deeper understanding of the research problem, the researcher asked participants to identify examples of learning difficulties that learners face, specifically with regard to language learning. The researcher expected to discover a variety of learning problems, but found that across all schools, and from both individual and group facilitators, as well as key informants, there was a common agreement that the biggest underlying learning difficulty that learners face is that they are required to learn in a language with which they are not familiar at all: English (E1:42–46; E2:76–81;
This confirmed the researcher’s correct identification of the necessity of addressing the problem of additional language acquisition. Compiled below is an overview of participants’ responses regarding this underlying barrier to learning, which builds on the findings reported in the Literature Review. Hereafter follows an exploration of the specific language learning difficulties that facilitators grapple with as a result of this underlying problem, which aids with elucidating the research gap and allows for a better understanding of the needs that the design intervention must address.

4.5.1.1 Basal Barriers to Learning

At all three schools and subsequent centres, facilitators (EF4:43–55; TF1:19–20,41–43; TF2:1:30–31; TF2:2:17; TF3:15–16; VF1:55–58; VF2) confirmed that the language of instruction was English, and that English was taught as the Home Language subject, but that the majority of students’ mother tongue was not English. Learners’ mother tongue languages were typically African languages, and included languages from South Africa, as well as languages spoken in other African countries (TF1:19–20; TF2:1:61–63; TF3:18,23,56–58). The language that is offered as the FAL at the three schools was either Afrikaans or isiZulu, depending on the school and the grade of the learner. English is thus technically the learners’ second language, but they are required to study it at Home Language level, and Afrikaans or isiZulu – which is offered at FAL level – is often the learners’ third language. Furthermore, learners have little to no exposure to English in their home environments, and they thus start school with no foundational knowledge of English, or even literacy (E1:43–45,76–78; EF1:44–48,55–58; EF4:43–53; TF1:41–43,52–53; TF2:1:61–64; TF2:2:43–45; VF1:55–58,87–88). This essentially poses a “language barrier” (TF3:48), and English is subsequently approached as a foreign language (EF4:43–48; TF2:1:53–58). Nonetheless, these learners are expected to perform at the same level as learners who are native English speakers (TF2:1:35–38), and this begets other learning difficulties, such as social, behavioural, and cognitive issues (E1:54,68–69).

What this shows is that learners located in the study area are, in fact, required to adopt English as the LOLT upon entering FP, not upon entering IP as is outlined by DBE and as explained in the Literature Review. This means that learners are expected to adopt English as the language of instruction without having had any prior exposure to the language. This is especially troubling since learners are expected to “[learn] to read and write” in a language which is entirely foreign to them, without the vocabulary or comprehension of English to help them with this transition (TF2:1:82–98). Furthermore, most learners also do not have the opportunity to study their mother tongue at all (E2:76–86; TF2:1:52–77), which fundamentally contradicts the notion of additive bilingualism that is promoted by the DBE.
As pointed out by E1 (105–111), E3 (83–89), EF1 (55–58), EF4 (51–53) and VF1 (85–89), minimal exposure to English is a problem that is especially prevalent in learners who are from underprivileged backgrounds, low socio-economic statuses, or government schools. As mentioned before, all three schools specifically serve areas or communities that fall under this description. Additionally, one of the biggest hindrances to language learning that arises in learners who are from underprivileged backgrounds, is that they typically have no reading culture in their home environment, and no or limited access to books, magazines or even television\(^2\) (EF1:55–58; EF3:311–313; TF2-1:162–172; VF1:85–89; VF3:53–57). Some participants also identified the following learning difficulties that specifically affect learners from low-income backgrounds (many of which echo the difficulties mentioned throughout the Literature Review): poor concentration due to being undernourished (EF2:58–59; VF2:105–106); parents themselves not having a high level of education or understanding of English, and thus not being able to support learners with their homework (E1:76–78; EF4:51–53); large, overcrowded classrooms in underprivileged schools that prohibit individual attention being bestowed upon learners (EF1:42–48); and limited teaching materials and resources (including therapy) being available in schools (E1:46–49,143–146,154).

Furthermore, due to the education policy that states that learners may not repeat a grade more than once, E1(49–53) and EF1 (50–52,59–61) have found that learners are often promoted to a higher grade, even though they have not attained suitable academic achievement and are not necessarily able to cope at this academic level. E1(51–52) has found that when assessing children who are in their IP, some learners present with the reading and comprehension capabilities that would be expected at Grade 1 level. This undue promotion of weak learners results in classes that reflect a wide spectrum of learner capabilities, and places a massive strain on teachers to try to accommodate “such a diversity of needs” (E1:58). Because teachers are already overburdened by the CAPS curriculum and administrative work, this added strain means they cannot manage their classes (E1:56–58). Additionally, E3 (51–54,65–67) believes that even though many SA learners appear to present with learning problems, these are not “genuine” problems, but are issues that arise as a result of poor teaching practices, from teachers who themselves are disadvantaged or inadequately trained, and are therefore unable to help learners (E1:56–58; E3:58–67; EF1:48–50; TF1:43–45; VF2:37–41). E3 (54–62) elaborates by stating that poor teaching is a hereditary problem, as teachers tend to revert to teaching the way in which they themselves were taught. E3 (67–72) believes that most of the learning problems faced by SA learners could be remedied with good quality teaching.

\(^2\) Although reliance on television as the primary source of entertainment is problematic (EF3:311–313), it is a means of exposing learners to new concepts (VF3:81–83).
4.5.1.2 Resultant Learning Difficulties

The “language barrier” (TF3:48) described by the participants in the previous section, causes three learning difficulties that specifically affect language and literacy acquisition. These are pronunciation, comprehension, and vocabulary, and appeared among answers from both group and individual facilitators. Identification of these language-specific learning difficulties provided insight to the specific language-related problems that could be addressed by the design intervention.

Difficulties regarding the understanding and pronunciation of vowels was a recurring theme throughout participant feedback (EF2:37–45; EF3:63–65; TF1:50; VF2:38–41), however EF3 (63–65,70–78), TF2-2:43 and TF3 (64–66) mention difficulties with pronunciation of sounds in general. Participants (EF2:37–41; EF3: 63–65,70–78; TF1:50–53) speculate that this is because the variable pronunciation of sounds – and vowels in particular – in English is very far removed from the pronunciation of the same letters and diagraphs in African languages, and that this is coupled with the learners’ limited exposure to, and use of, English. EF3 (70 –78) compared the sound of ‘a’ in ‘abantu’ with ‘apple’, or ‘th’ in ‘thanda’ with ‘them’, TF3 (57–59), however, commented that learners who have neither English nor isiZulu as their mother tongue, tend to confuse vowel pronunciation and sound blending between the two languages – TF3 (50–52) provided the example where the ‘u’ in ‘umbrella’ is pronounced the same as the ‘a’ in ‘abantwana’. VF2 (37–41) also called attention to the fact that very often teachers themselves are not native English speakers, and even they sometimes have trouble with the language, which can affect their own teaching, or prevent them from correcting pronunciation problems that learners might have.

The second problem that results from limited exposure to, and understanding of, English, is a very restricted vocabulary (E1:91–113; EF4:50–51; TF1:45–46; VF2:46–49; VF3:53–69). Literacy is taught by learning the sounds, whereafter the sounds are ‘blended’ into words, however constructing words through blending is only successful if learners are familiar with the words (TF1:62–65; VF1:89–102; VF2:52–56). Learners are often unfamiliar with the vocabulary that appears in the reading resources that are available to them, even if they are conducive to the SA environment (for example, ‘turtle’ or ‘hippo’, or any discussion around the topic of ‘the beach’) (E1:91–113,120–127; VF3:45–51). Furthermore, some reading resources draw from American or British culture or words that are not common in the SA context at all (VF2:64–65). Limited vocabulary, combined with low confidence, also means that learners battle to verbalise their thoughts and feelings, which encumbers conversation and the development of the language (EF3:349–351).

3 The researcher noted that it is difficult to ascertain whether or not a resistance to conversation or verbalisation is due to limited ability with the language, failure of comprehension, or simply a personality trait of the learner (such as shyness).
Unfamiliarity with vocabulary inhibits comprehension of reading materials (E1:120–127; VF1:105–110,205–206; VF2:46–50,56–63; VF3:45–51), which is the third problem that stems from limited exposure to English (E1:43–45; TF2-1:61–63,70–72,120–140). E1 (91–113,120–127) and VF3 (53–57) elaborate on this, and believe that limited vocabulary is also a result of learners’ experiences of environments being restricted to their own communities, as they do not have the opportunity to go on field trips, or holidays. VF2 (48–50,62–63) mentioned the words ‘fair’ and ‘circus’, and E1 (98–104,110) mentioned ‘sandcastle’, ‘jellyfish’ and ‘picnic’, as examples that prohibit vocabulary development and comprehension, however by looking at the resources that are available at C3, the researcher also observed images that depicted a polar bear, a whale, and a kangaroo, and actions such as swimming, blowing, and hopping (see Figure 32), all of which the researcher believes may pose challenging for young, struggling learners as these words are “not part of [the learners’] world” (E1:99). Although not overtly stated, heuristic deduction leads the researcher to believe that the unfamiliarity of reading material ostracizes learners to some extent, as they find no common ground with that about which they are reading, which in turn discourages an enjoyment of reading.

![Figure 32: Examples from a Pre-Red level reading resource at LC3 depicting examples of concepts that learners might struggle to identify and understand.](Photographs by author 2017)

Here, it is pertinent to refer to the 2014 ANA Diagnostic Report of Foundation Phase Mathematics and Home Language (DBE 2015a), as this provides an analysis of the various sections of the curriculum with which learners struggle. According to the report, FP learners struggle most with the writing of words and sentences (especially if unguided, for instance when only given a picture or topic to write about), story-sequencing, and grammar and punctuation (DBE 2015a:33–35). The DBE (2015a:60) also states that even though learners are capable of identifying basic phonics, “many still perform poorly in spelling and in using words to write meaningful sentences and paragraphs”, and that “a significant proportion of learners still experience challenges in providing responses to questions that require high order cognitive skills”, for instance discussing cause and effect, or giving an opinion (DBE 2015a:4,58). The 2014 ANA results thus align closely with the primary research
findings, with the three most problematic subject areas being writing, language use, and reading and comprehension (DBE 2015a:37,44,51).

4.5.1.3 ADDRESSING LEARNING DIFFICULTIES

The approach to addressing the aforementioned learning difficulties varied amongst participant responses and, although there were some overlapping answers, there were no significant themes. Many of the facilitators who volunteer at The Link believe that because learners present with such a broad range of capabilities, the learning difficulties are best remedied through one-on-one support (EF1:80–81; VF1:109–110; VF2:192–193 and corroborated by E1:89–90), or by addressing an individual learner's personal needs and learning level (EF2:156–161; EF3:308–311). Responses from the facilitators who are involved with group teaching indicate that they generally tend to rely on the use of support materials or resources to address learning difficulties (E1:134–146; TF1:72–92; TF2:2:55–56; TF3:103–105). TF2-2 (76–79) and TF3 (69–78) both mentioned practicing or repeating various elements with which learners struggle through supportive learning aids, and TF2-1 (150–152,160–177,188–191) mentioned resources like The Link, Reading Eggs (discussed in 2.5.1) and the school library to support all learners, especially with regard to increasing their exposure to English.

In general, learners' limited exposure to English is addressed by attempting to immerse learners in the language (EF4:59–64; VF1:105,236–238), by focusing on encouraging conversation (EF3:176–187,332–334; EF4:60–61), increasing availability of resources (E1:134–146; TF1:86–92), and through a multifaceted teaching approach (focusing equally on reading, writing, speaking and listening) (EF1:88–110; EF3:347–351; EF4:59–64,68–79; TF1:72–82). The problem of poor pronunciation is mainly addressed through repetition and practice (VF2:52–62; TF3:62–66,69–71), and by reinforcing learning topics through novel and interesting ways, such as games or exercises that target specific learning difficulties (EF2:156–162) or through visual support materials (E1: 134–146; VF2:70–73). The problems with limited vocabulary and handicapped comprehension are addressed differently depending on the facilitator: VF3 (47–49,81–83) tries to expose the learners that fall under her tutelage to some of the unfamiliar concepts by showing the learners images or video clips on her phone during the sessions; VF1 (92–95) recommends introducing learners to more obscure or complicated words; VF2 (56–63) constantly explains unfamiliar words to her learners and frequently asks them “do you know what that means” to ensure their comprehension; and EF3 (176–187,195–197) similarly asks questions to encourage enjoyment and to check that learners are cognisant of what they are reading (for instance, asking questions about the accompanying illustrations).

The previously mentioned ANA diagnostic report also suggests remediation strategies for the problem areas faced by FP learners. Grade 1 teachers should focus on teaching phonics through
word and sentence building exercises aided with flashcards, incorporate more oral exercises (especially those focused around story-telling), and increase learners' exposure to vocabulary (DBE 2015a:39,40). Grade 2 teachers must incorporate oral exercises to improve learners' vocabulary, increase exposure to oral and written comprehension exercises, and emphasise sentence construction through sight words and phonics (DBE 2015a:45,49). And Grade 3 teachers need to introduce learners to a greater variety of texts to test their comprehension, encourage story-writing based on a familiar context or framework, and expose learners to higher order and open ended questions (DBE 2015a:53,55,60).

4.5.2 INSIGHT INTO LANGUAGE ACQUISITION

All participants who were asked about the role that language learning plays in a child's development concur that the acquisition of an additional language benefits children in a multitude of ways (E1:203–210,269–276; E2:104–108; E3:77–79; EF1:33–39; EF3:37–44; EF4:30–39). The Es and EFs interpreted the question as referring to the learning of English as an additional language. E3 (77–79), EF1 (33–34), EF3 (41–44) and EF4 (38–39) all commented on the advantages of learning a language while still young. The learning of English as an additional language is considered essential by these participants, as it enables learners to communicate and interact with those around them (E1:66–78; E2:20–22,80–81; E3:81–85; EF1:35–36; EF4:30–37); it boosts a learner's confidence, which motivates them to learn (E1:66–78; E2:104–109,152–154; EF1:35–36); and it increases future opportunities for work and education (E3:84–85; EF2:30–32,34; EF4:30–37). Furthermore, without language, children cannot read; and if children are not able to read, they cannot learn (EF2:30–32,34). E1(66) believes that language learning in general (both the mother tongue or additional languages) is critical since it “plays into all domains of functioning”, and E2(104) commented that language “gives [children] everything; it gives them control”. EF3 (38–39) does however warn that being exposed to multiple languages can be confusing to children (which echoes TF3’s (49–56) commentary on learners confusing sounds used in English and isiZulu), but that extensive exposure to languages, especially while young, helps encourage language acquisition. Additionally, E2 (122–124) does specifically caution against the learning of multiple languages for children who are in a predisposition to language learning due to developmental delays.

Participants were asked what they believed to be the most successful way to teach a second language. The responses from the individual and group facilitators differed notably. Unsurprisingly, The Link participants favour methodologies that are conducive to one-on-one teaching, whereas group facilitators rely on strategies that teach the whole class simultaneously. Group teaching is naturally more appropriate for SA classrooms, but – as identified in the Literature Review, and mentioned by TF3 (107–112) – one cannot deny the benefit of individual teaching. Although E1(83) does not address language-learning barriers in the classroom directly through learners, she works alongside teachers to devise intervention strategies that ameliorate any learning difficulties. Due to
a combination of large class sizes, a lack of therapists, the diversity of types of needs, and the range of learner ability, E1’s (90) experience shows that it is very difficult to target individual learners in a class environment, however, she did state that “if you put an intervention in place for one child, it can benefit the entire class”. This echoes the Literature Review, which stated that when solutions are designed around the criteria of those who are “hardest to reach” (like disadvantaged or struggling learners), as opposed to those who are “easiest to reach”, the results are more effective and more extensive (UNICEF 2014a). Herewith follows a brief overview of the differing approaches to additional language acquisition through The Link versus in the classroom.

4.5.2.1 LANGUAGE LEARNING THROUGH THE LINK

Nearly all participants who volunteer at The Link mention that The Link’s success with facilitating the learning of literacy cannot be attributed to any one of their strategies (paired reading, activities, or stories), and that they all reinforce one another (EF1:88–89,109–110; EF4:92–104). EF4 (70–71,96–97) did, however, comment on the importance of the ‘activity slot’ because the learners are almost unaware that they are learning since they are “having a bit of fun”. Some of the common themes regarding additional language teaching strategies included: extensive exposure to the language being taught, through reading, writing, listening, speaking and doing (E1:100,111–112,271–272; EF1:88–110; EF3:37; EF4:68–79); using a variety of activities and approaches to involve learners, in order to reinforce the topic of learning (EF1:88–110; EF4:79,104); appealing to different learning styles, depending on the learner (visual, auditory, reading / writing and kinaesthetic) (E2:145–147,154–163,176–182; E3:97; EF4:68–79); and repetition of problematic topics (such as sight words or vowel pronunciation) (EF2:37–45; VF2:38–40,52,194).

EF3 (49–56,132–134) and VF2 (71–73,103–104,173,195) believe that if young learners are unfamiliar with a language, the learning of the language is best facilitated with extensive visual support (such as pictures). EF3 (49–58,132–135,138–142,148) elaborates on this by explaining that being able to ‘read a word’ is of no use, unless the learner understands the word, and the context in which it should be used (for example, being able to read ‘kite’ without knowing what a kite is) (EF3:49–58). EF3 (49–58,132–135,138–142,148) explains that it is easier for children to learn new words or concepts if they are able to see or experience these in some way. Although not a facilitator, E1(92–127) corroborates this, and emphasises the importance of what she calls “pre-teaching” (whereby concepts and contexts are broadly introduced, before actively developing vocabulary). Furthermore, E1(91–116), E3 (95) and EF3 (118–121) elaborate that learning should advance from the concrete, to the semi-concrete or representational, to the abstract. Learning an additional language should therefore start with introducing the most basic sounds and words first, and then building on these incrementally as learners progress (for example, building ‘shin’ into ‘shine’ into ‘shore’) (EF3:106–109), and it is important that sounds, blending and reading skills are developed alongside meaningful vocabulary building and holistic comprehension (EF3:90–109).
Learners thoroughly enjoy the sessions that they spend at The Link (EF2:162–163; EF4:92–102; VF2:86–89), not only because of the opportunity they get to play games (second time slot) and being read to (third time slot) – both of which are activities learners are not generally exposed to in the classroom or home environment (EF3:299–301; EF4:92–102; VF3:53–54,93–94) – but also because learners thrive off the attention and the opportunity to develop a personal relationship with the volunteers, due to the one-on-one structure of The Link sessions (EF3:297–301; EF4:100–102). In addition to the “special” attention (EF3:300), EF2 (128–133) and VF2 (196–204) both reiterated the importance of praise and empowerment; even though this does not directly impact their abilities, if learners believe that they can read it makes a significant difference to their motivation. This encouragement builds their confidence and self-esteem, which increases their willingness to try harder (EF2:128–133; VF2:187–188,196–204).

4.5.2.2 LANGUAGE LEARNING IN THE CLASSROOM

The facilitators who teach in group contexts provided greater insight as to how they approach the teaching of English (taught as the Home Language subject, although a second language to most learners) within the constraints of the CAPS curriculum. TF2-2 (63) and TF3 (62–64,69–70) both emphasised the importance of using phonics (the breaking down of words into individual sounds) when teaching English, and using this to incrementally ‘build’ more complex words (as is recommended by the CAPS guidelines (DBE 2015a:71–72)). TF3 (62–66) also warns of teaching ‘letters’ as opposed to ‘sounds’ as this can lead to confusion (for example, the letter ‘b’ is pronounced as ‘bee’, however phonemically it sounds like ‘buh’). TF1 (72–92), TF2-2 (63–64) and TF3 (80,91–93) all incorporate non-academic activities into their teaching approaches, such as playing games like I-Spy (TF2-2:64), allowing learners freedom of creativity (TF3:91–93) (also recommended by the DBE (2015a:72), especially in order to remediate learning difficulties), or incorporating multisensory activities that encourage ‘full-body’ learning (TF1:72–92).

TF2-1 (120–140) and TF3 (70–71) also comment on the necessity of ensuring that learners comprehend each word that is learnt. This echoed some of The Link and key informant participants’ responses regarding comprehension and contextualisation, however the teaching strategies differ. TF1 (64–75) and TF3 (80) reinforce vocabulary learning by instructing learners to draw “diagrams” (TF3:80) or pictures, either in their workbooks or on their white boards. This enables learners to understand the vocabulary within the correct context, and ensures that learners remember the word. Hereafter, TF3 (80–89) typically exemplifies how the word is used in a sentence, and once the word has been used in a sentence, the sentence can be broken down into parts of speech, punctuation, and other grammatical elements. TF2-1 (120–140) promotes a similar strategy, explaining that comprehension needs to be developed alongside appropriate grammar structures and vocabulary, but that a relevant and familiar context is all-important to successful learning. Comprehension exercises are thus very valuable and useful, as they provide contexts for learning, and allow for
exposure to new themes, sounds, vocabulary, grammar, and verb structures (TF2-1:120–140). Reading books can similarly provide a frame of reference in which learning can take place, and exposure to such ‘contexts’ encourages self-driven or self-reliant learning (TF2-1:155–177). Although their approaches differ slightly, TF1 (72–80), TF2-1 (120–140,143–146) and TF3 (73–74) both promote holistic teaching, and point out that vocabulary, in particular, cannot be taught in isolation, as this does not encourage understanding (this is corroborated by E1(91–116)). Overall, the TFS’ approaches to teaching literacy do reflect the DBE’s (2011b:14,16) suggestions of focusing on phonemic awareness, vocabulary, word recognition, comprehension, and fluency.

### 4.5.3 Identifying Learning and Teaching Support Materials

There was a significant difference regarding the findings on LTSMs that are available, and utilised, in the one-on-one learning sessions at The Link centres, in comparison to those that feature in classroom use. The various key informants also offered unique insight to the matter. The findings have been discussed accordingly.

#### 4.5.3.1 LTSMs at The Link

Since observations by the researcher and introductory discussions with H4 had established that The Link does make use of support resources to aid in teaching literacy (books are used in the first and third time slot, and a range of different games and activities during the second time slot), participants were asked about what resource they found most beneficial, and which resources learners respond to best. The overwhelming majority of The Link participants responded that learners “love” (EF1:115–120) any games or activities that allow them to throw dice, or move disks, or manipulate cards (EF1:115–116; EF2:139,257; EF3:164–169; VF2:81–82; VF3:190). Essentially, learners find great enjoyment in the games or activities that incorporate an element of tactile interaction or kinaesthetic stimulation (see Figure 33) (EF3:264,304; VF2:161–164). But this being said, EF4 (83–86), TF2-1 (203–223) and VF1 (122–141) caution that there is no single game that works for or appeals to every single learner, and that the researcher would do well to try to appeal to all learning styles (visual, auditory, reading / writing and kinaesthetic), or to incorporate aspects of each into the end product (EF4:68–79). Participants do, however, seem to find that active interaction (or “doing something” (EF2:241–243; EF4:74,86)) is the best way of engaging children in the learning activity\(^4\) (E1:179–187,269–272; E3:96–107,239–242; EF3:124–127,304–305; EF4:86–88; VF2:129–133; VF3:94–98).

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\(^4\) It must be noted that VF1 (177–179) offered an alternative view on this matter, stating that many of the existing games are dice-based and that this limits the variety that is available, which results in learners becoming bored with these activities.

\(^5\) Being able to capture and retain a child’s attention appears to be a recurring challenge faced by The Link participants, as learners are very easily distracted (EF3:172; VF2:177–181), and become more interested in what is going on around them, rather than remaining engaged with what the volunteer is busy with (EF3:172,264–271,275–283). Some participants offer explanations for this, but in the researchers’ opinion, it may just be that children of this age group have a limited attention span.
and through this, learners are often more absorbed by the ‘fun’ aspect than the ‘learning’ aspect (E4; VF2:129–133).

Figure 33: Examples of resources that are available at LC1 that combine kinaesthetic interaction and game-play into academic activities. Both have been developed by VF1. (Photograph by author 2017)

Learners also respond very enthusiastically to games that are visually stimulating, and feature bright colours, or vibrant pictures or illustrations (EF1:117), and most learners enjoy activities that present a competitive element (E1:264; EF1:240–242; EF2:141–144; EF4:97; VF3:92,170–173,190–191,195–202). EF1 (148) explained that there are some learners who do get upset about “winning or losing”, but that learners need to understand that this forms part of life’s experiences, and that it is important for learners to “learn to lose with dignity and grace”. In addition to learning literacy and language through the available games, E1(264–269) and EF1 (132–150) both see this as an opportunity for learners to also learn the “rules of social behaviour” (EF1:136), by following the rules, and allowing each other turns.

Learners also enjoy games that challenge them (EF1:119–120), games that appeal to their sense of risk or anticipation (EF3:168–169,413), activities that encourage a sense of achievement (VF2:200–204), activities that allow for interaction between the volunteer and the learner (EF1:118), and games, concepts, and words that the learners can identify with, and that are relevant to their own experience and scope of vocabulary (EF1:120–122). But most of all, learners are attracted to games that are fun and enjoyable (EF1:119,224–226,243; EF2:139; EF4:68–71,184–188; VF2:81–82,86–96). Learners do not respond enthusiastically to games or activities that are overtly academic or intellectually demanding (reading or identifying sounds, writing based, or making up sentences) (EF2:139–141; VF2:179–180), and E3 (312–322,342–343) believes that enjoyment should be prioritised over academic achievement. EF2 (161–162) also stated that learners need to “see the application of what [they are] learning in a more interesting way”, and that learners take great pleasure in the surprise of unconventional or novel approaches to reinforcing their learning (VF2:93–96,136–138). This being said, E3 (312–322,342–343) and VF3 (178–185) believe that the activities
or games should ideally provide a combination of entertainment and learning aspects, and VF1 (124–127) believes that although having fun has its place, it has to be meaningful or serve a purpose, and that the ‘play’ activity should reinforce the topic of learning (refer back to Figure 33). A few of the participants also commented that children do enjoy being read to (EF4:98–100), and although this is a passive activity that does not rely on any innovative resource or game-play, it should not be discredited.

Throughout the interviews, the researcher was also made aware that some children arrive at The Link centres and they “[do not] even know how to roll a dice” (EF2:142), and that the basics of game-play are not necessarily familiar to learners from disadvantaged backgrounds, since few learners are exposed to such activities at home (for example, snakes and ladders, or puzzles) (EF2:142; EF3:239–240; VF1:263–264; VF3:91–94). Subsequently, the novelty posed by the games, activities or resources that incorporate such elements are what capture children’s attention best.

When asked about resource shortfalls, the most prevalent trend showed concerns regarding variety (EF2:156–158; VF1:158–159; VF3:104–105). The commentary on variety tended to be twofold: firstly, because there are a limited number of games it means there is a finite amount of ‘replay’ available before learners – and facilitators (VF3:104–105) – become bored (EF2:156–158; VF1:122–124,158–159; VF3:104–105); and secondly, the available games cannot all be adapted to accommodate the needs of the full range of learners (outliers on either end are excluded), which means that the stronger learners do not find the games challenging enough, whereas the weaker learners need games to be simplified or adapted from current form in order to suit their restricted capabilities (EF2:156–158; VF1:129–139).

Another criticism of available resources was that many are American, or British, but barely any are SA, or developed with SA learners in mind (EF3:200–203,217–220; VF1:147–154; VF2:64–65). Although not used in language learning, E1(218–225) made a similar comment with regard to the games she uses for therapy and learner assessment. Although the games are adaptable and translatable, the contexts and vocabulary are sometimes very euro-centric or are of no relevance SA learners (E1:218–225; EF3:202:203; VF1:147–154). This being said, EF3 (200–209) does believe it valuable to include some of the ‘irrelevant’ words and concepts, since learners can be introduced and exposed to a broader understanding of the world. EF3 (204–206) believes that The Link’s responsibility to teach learners literacy should extend to also support general knowledge development, and as EF4 (102–103) said, learners love to learn about “new places and new things”.

It must be noted that the researcher did observe a number of reading resources at C3 that have been developed and published in South Africa, and that these do depict people, environments and activities that learners from low-income backgrounds may recognise or find more relatable, such as informal settlement housing, African characters and more familiar amenities (see Figure 34).
4.5.3.2 LTSMs in the Classroom

Feedback from group facilitation participants (TFs) was significantly less in-depth than those provided from The Link’s facilitators. To some extent this can be attributed to the fact that schools simply do not have the budget for additional support materials, as stated by E1(143–146,154–155), EF3 (213–216) and TF2-1 (155–156). TF2-1 (159–177,188–197) did however identify The Link’s involvement and the Reading Eggs program as both having been very beneficial support resources, and emphasised the value of the school library as means of encouraging literacy and increasing learners’ exposure to English, especially since learners typically do not have access to books or other resources in their home environment. TF2-1 (188–197) also commented that learners respond very positively to the Reading Eggs program, and stated that the simulation of individual teaching and positive reinforcement were very beneficial.

When asked about the learning aids they use in class, both TF2-2 (55–56,69) and TF3 (112) responded that they use “charts” (TF2-2:55–56,69; TF3:112) (see photographs in Figure 35), “cards” (TF3:103,112) and “flashcards” (TF2-2:69–70; TF3:103) that they developed and made themselves. In both cases, it appears that the facilitators make the resources depending on the requirements of the learners or what is needed to complement the syllabus (TF2-2:55–56; TF3:103–121). TF2-2 (76–
79, 87–88) believes that her resources can be improved by incorporating additional visual elements (colours and pictures) to reinforce the topics of learning. She also described that the inclusion of pictures could make learning vocabulary easier for the weaker learners, as they would be able to recognise the image instead of the word (identifying a picture of a cat, as opposed to reading the word ‘cat’).6

![Figure 35: Examples of the support resources developed and made by TF2-2 for her Grade 3 class to assist them with learning English. (Photographs by author 2017)](image)

TF3 (97–100) also commented that listening and speaking are very important ‘resources’ and she devises exercises based on listening to the radio, and spends time reading a variety of stories (Big Books) to the learners. Similarly, TF1 (72–77) encourages the use of books (particularly those which incorporate rhyming) and audiobooks. TF3’s (103–105) learners also have access to individual white

6 At first, this concerned the researcher, because even though this strategy would support vocabulary building, it does not necessarily develop reading skills. However, EF2 (130–131) described a similar resource she referred to as a “sound book”, which consist of opposite pages depicting a picture and the correlating word. Although EF2 (131–133) did concede that this resource relies more on picture recognition than reading, she also explained that it aids with the preliminary building of vocabulary and makes literacy available to the weaker learners.
boards on which they can draw with markers, as explained previously. TF3 has found these to be an invaluable resource, and it appears that learners respond very well to this (TF3:107).

4.5.3.3 Alternative Views

The various key informants were also requested to provide examples of beneficial support materials, and offered unique insight to the matter. When E3 (111–117) was asked about the most beneficial support resources to aid with teaching an additional language – bearing in mind her position as a retailer of learning resources – she astutely answered that the best learning tool is a qualified, motivated, competent teacher; for if the teacher does not use a support resource correctly, or at all, the resource serves no purpose and is of no benefit to the learners. E1(134–145) also provided an unexpected answer to the question, by stating that expensive equipment and toys are not necessary, and that teachers should be able to facilitate learning in an enjoyable way, irrespective of the limitations of available resources (corroborated by E2 (262), who stated that she often does not use a support resource at all during therapy). E1(134–135) elaborated that learning can be made exciting and engaging with very limited resources (like a piece of paper and a pencil) and that teachers and learners should apply and extend their imaginations.

When further questioned about the types of resources that are most appropriate for supporting additional language learning, E3 (219–232) answered that children respond well to stories, songs and rhymes (all of which encourage phonemic awareness), as these are fun and engaging, but also stimulate learning through contextual relevance and repetition, but without being very ‘academic’. This response tied in with E1’s (134–135) view, as stories, songs and rhymes do not rely on any additional support materials or products. E1 (111–112) did, however, also state that “[o]ne of the greatest interventions you can put in place is to have a lot of media, a lot of books” and other resources available, to use to introduce less familiar concepts. This echoes what was mentioned in the Literature Review; that schools do not need high-cost investments, as merely increasing the “availability of textbooks… [is] one of the most cost-effective ways of improving primary school achievement” (Fleisch 2008:130,132).

Building on her view that learning should be made fun and engaging, E1(154–155) stated that “the demands of the CAPS curriculum do not allow children to play”, and that facilitators need to make a concerted effort to encourage play in their classrooms to prevent “children [from being] left at their desk for extended periods of time”. According to E1(192), “a lot of people think that play could be a waste of time”, however the importance of play (especially for younger learners) cannot be

7 E3 (371–376, 403–419) also shared some examples of language development precedents she has had positive responses to. These included games called Spot-It (which is very engaging, has a strong visual component, and has a competitive element), and Pop (a game which relies on chance, can be played in groups, and is available in sets that address specific sounds or sight words).
emphasised enough, since “everything” – especially children’s emotional wellbeing – revolves around play, and the social element of play. E1(192–210) and E2 (221–223) both believe that it is detrimental to a child’s learning if they have no opportunity for play, or to facilitate learning through play. E1(203–205) explained the direct correlation between language ability, opportunity to play, and a child’s happiness, and stated that her own research has shown that children who cannot play are the children who have a tendency towards depression, anxiety, and emotional difficulties, and that – to a great extent – this can be mitigated by encouraging language and communication (with parents, teacher, and peers).

4.5.3.4 Market Gap

The key informants and expert facilitators, who are more involved in sourcing, choosing and even developing resources all believe there is a gap in the market for educational toys that address additional language acquisition, or that are specific to the SA context (E1:218–225; E3:218–219; EF1:164–173; EF2:173; EF3:217–220,223; EF4:111–113). EF1 (167–168) elaborated by commenting that educational toy shops stock “mass-produced, plastic-y toys that very rarely enhance the child’s creative abilities, or the child’s linguistic abilities”. EF3 (219–220) also explained that even though there is a gap in the market, it is also a matter of making the resources available, accessible and affordable to the schools and individuals that need them most.

EF4 (111–113) is currently working on developing games and resources for all The Link centres to use, in order to standardise the support materials, and in order to develop products or activities that will target the stipulated learning levels around which The Link’s literacy program has been developed. This speaks to the shortfalls that were identified within The Link’s available LTSMs with regard to variety. Addressing a similar need, TF2-1 (101–104) is busy developing the phonics curriculum that is offered at S2 in order to target the learners’ specific needs.

In spite of developing and marketing her own resources to aid the learning and teaching of additional languages, E3 (218–219) believes there still is a big gap in the market for products that support this. It was, in fact, this gap in the market that originally inspired E3 (33–36) to co-develop the African Voices product range (Conversation Station and Viva Vocab, both discussed in 2.5.2.5), although she does identify shortcomings in both products. E3 (237–242) elaborated on the need for new products that are developed locally, stating that even though workbooks, story books and charts are available in all languages, the two-dimensionality of these products is not very appealing to learners,

8 E3 (142,153–154,163–168,170–182,185–193) commented that the Viva Vocab product requires significant development in terms of the production and manufacture of the cards and the packaging thereof. E3 (202–213) also identified that both products could be improved by being developed to accommodate the seven additional official languages, although she does believe that English should always remain at the core of the products.
as children require multisensory stimulation in order to be engaged in a learning activity. The researcher also noted that reading itself (facilitated through charts, workbooks and storybooks) cannot be relied upon exclusively in order to learn a language, as the learner’s literacy – irrespective of language – might be impaired.

### 4.5.4 UNDERSTANDING DESIGN REQUIREMENTS

The following section discusses and analyses the primary research findings regarding requirements for the design of an educational toy. All respondents were first asked what type of play should be incorporated into the design intervention, in order to best support a child in terms of learning an additional language. The interview question sheet provided a multiple-choice selection list of six different types of play and corresponding examples. These were as follows: physical play (e.g. swings, running around), imaginative play (e.g. dressing up, role playing), manipulative play (e.g. puzzles), creative play (e.g. building blocks), social play (e.g. use of tea sets), and exploratory play (e.g. nature/water play). Participants were also given the opportunity to respond with “other” and specify an alternative type of play. (The examples were given in order to aid those participants who were not familiar with what is meant with ‘play types’, however some participants appeared to interpret the given examples as the only examples, or as possible suggestions for the design intervention.) Hereafter, the researcher explained the concept of user-centred design, and the need for considering both facilitators and learners in the design of an educational toy. All participants were asked what their own specific needs (as secondary users) were, and what the specific needs of their learners (as primary users) were, regarding the design of an educational toy. The findings regarding these three questions are discussed and analysed below, by providing a general overview, as well as tabulations of the participants’ responses.

#### 4.5.4.1 TYPES OF PLAY

Participant responses to the inquiry as to the type of play to be incorporated in the educational toy have been logged in Graph 1. Two ‘other’ types of play were suggested, both of which were mentioned by more than one participant. These were multisensory play and play that relies heavily on visual stimulation. As can be seen in Graph 1, manipulative play was the most popular response across all participants (with seven counts), closely followed by social play (with six counts), and followed in turn by creative, multisensory and physical play (with five counts each). Responses showed a relatively even range of preference, irrespective of the sample group, however the sample groups did have some commonalities regarding the choices of their responses. These are discussed accordingly, below. It should also be noted that the majority of participants did mention that all types of play did have the potential to stimulate learning, and that the preference would depend on the individual learners, however the researcher did specifically request that participants identify those options that would be most beneficial or suitable.
The one-on-one facilitators who are involved with The Link (EFs and VFs) all based their responses on the constraints that result from the structure of The Link’s sessions. As such, most answers reflected game-play that is conducive to time constraints (EF1:185–186), and that can be easily managed on a desk (EF1:154–155; VF1:267–269). Manipulative play was deemed most appropriate by this sample group (EF1:115–116; EF3:264,304–305; EF4:86–88,145–150; VF1:263–264; VF3:91–96,102–104), followed by physical play (EF2:257,259,265; VF2:114–121; VF3:120–121,127–130), creative play (EF1:122–124) and social play (EF3:288,304; VF1:269–270; VF3:91–92,190–193). Although physical play might seem like an unusual choice, EF2 (187,268–269,272–274) explained that this can also include kinaesthetic elements or “small movements” that can be limited to a desk (such as rolling a dice, playing snap, moving a disk, or even pointing). Although The Link’s sessions are conducted on a one-on-one basis, VF1 (254–257,276–278) and VF2 (114–118) identified that the sessions are still conducted in group environments, as the learner-facilitator pairs are all located in the same hall or classroom. The play-activity can thus not be too disruptive or chaotic. Furthermore, VF1 (268–269) noted that C1 has very limited storage space, and that the designer needs to bear this in mind, although this is not necessarily true for all centres, as the researcher noted that C3 has an entire classroom solely dedicated to use by The Link (VF3:162).
Referring once more to Graph 1, it can be seen that there was no clear commonality in responses from the TF group, and all types of play, with the exception of physical play, were considered appropriate. TF2-1 (220–222) did however suggest that since the product will be targeted at the FP, that it should be based on “something concrete”, as opposed to “something abstract” (sentiments that were echoed by E1(254–256) and TF1:109–121). Although referred to in different capacities, both TF2-2 (87–88) and TF3 (143–147) mentioned play that should allow for variety: TF2-2 (91) suggested the incorporation of an audio-visual aspect to allow learners to ‘learn’ from someone who is not the teacher (such as hearing a different voice to the teacher, in reference to the Reading Eggs program); and TF3 (143–147) suggested that exploratory play would allow children the opportunity to experience the outdoors, as they are often confined to being indoors both at school and in their home environment. This echoes Fenton’s (cited by MacBlain 2014 ch.5 sect.7) sentiments, as he also believes it important that children engage in ‘real’, physical play and that they have regular interaction and contact with peers and adults, especially since most forms of entertainment tend to be sedentary and screen-based.

Imaginative play and creative play were also mentioned across all groups, however imaginative play in particular appears to be something that learners battle with (EF2:192–195; EF3:308–313). Learners seem unable to imagine a story unless it is guided with illustrations or prompts (EF3:310–313), and they are not prone to applying themselves intellectually, unless they are specifically required to do so (EF2:192–195). EF2 (192–195) explains that if learners are required to “make up a sentence”, they will “do what has to be done”, and do not try to challenge themselves. EF3 (315–319) corroborates this by stating that one-word answers to questions tend to supersede complex sentences, especially when learners are required to “think for themselves”. EF2 (191–193) and EF3 (264–267,315–319) speculate that this may be due to limited opportunity to indulge in imaginative play at home or in the classroom, or that when given the opportunity there is very little that is contextually relevant and relatable that learners can draw from (also corroborated by VF3:53–57). Although imaginative play might be hampered by the time restrictions posed by The Link’s sessions, and the learners’ unfamiliarity with imaginative play, this is an untapped area of opportunity from which learners can benefit (EF2:187–188; VF1:257–261). EF3 (327–337) does however warn that some volunteers are not very enthusiastic to engage with resources that require too much of their own thinking or imagination. Furthermore, TF1 (132–136) did specifically advise against the incorporation of imaginative play, as children with far-reaching learning difficulties (for instance, autism, with which some of the learners who attend S1 present) become confused when they are required to rely on abstract concepts.

Although not overtly discussed, the development of other skills through different kinds of play was also mentioned throughout the interviews, such as developing social skills through social or participatory play (for instance, sharing, turn-taking and following rules) (E1:264–269; EF1:132–141;
VF1:274–277), developing fine motor skills through manipulative play (VF1:263–266), or developing coordination through physical play. E1(270:272) and E3 (277–288) explained that even if children are playing something that seems distinctly entertainment based, they are still learning language skills just by engaging in conversation. The key informants were particularly supportive of social play as it “encourages the sense of ubuntu” (E3:279), encourages greater “teacher buy-in” (E3:285) and it allows children to learn through their peers, as opposed to just through the formal curriculum (E1:271–272).

4.5.4.2 SECONDARY USER REQUIREMENTS

As the secondary users of the design outcome, the facilitators and key informants were asked what their specific needs regarding the design of an educational toy are. Graph 2 shows not only participants’ direct responses to this question, but also the requirements that were identified and deduced by the researcher through analysis of, and reflection on, participant responses throughout the interviews. As can be seen in Graph 2, the most prevalent secondary user requirement is that the product must simple to use and understand (with 12 counts). This is followed by considerations for the physical management of the product (with seven counts), the similar requirement that the product be manageable, and the product evidencing an academic purpose (with six counts each).

The next priority is shared by consideration for the facilitator finding the product enjoyable to use, the product being adaptable or suitable to use in various time constraints, and the durability of the product. These ‘top priority’ design requirements are discussed in greater detail below, where it can be seen that the commonality to all these considerations is that they encourage facilitators to use the product.

As with their responses to the question regarding types of play, the responses from participants who are involved with The Link (EFs and VFs) reflected requirements that would aid the facilitation of the one-on-one support structure, and the 15-minute ‘activity slot’. Similarly, and unsurprisingly, the responses from the TFs reflected the needs of supporting language acquisition in a group environment (such as the product being conducive to use in small groups). Nonetheless, participants from all sample groups felt that the product needs to be self-explanatory, or easily understandable in lieu thereof. This links directly to the requirement of the product being adaptable to use in various time constraints: The Link facilitators have a very limited time allotment (15 minutes) during which to read and understand the instructions, explain these to the learner, set up the product, and use the product effectively without disruption (EF1:185–189; EF2:229–231); and the TFs are equally faced with time restrictions during classes, and are required to explain the instructions to a full class of learners (E1:312–317; TF2-1:230–238,272–273). In both cases, ensuring that the facilitators understand the product quickly and easily allows them to see the value thereof, which in turn means they are more inclined to use the product (E3:226–227,312:322,329).
The physical management of the product should also be considered in terms of individual and group settings: the product should be quick and easy to unpack and repack (E3:373–375; TF2-1:230), it should not demand excessive storage space (VF1:267–269), and it should not consist of many pieces, but if this is the case, the product should be functional even if pieces go missing (E1:312–313; TF1; TF2-1:230–234; VF1:306). These considerations ensure easier classroom management, which also encourages facilitators to use the product. This links closely with the requirement of manageability, which refers to the aforementioned consideration for the product being conducive to use on a desk, and that the use of the product will not detract others in the same space (EF1:155; EF4:144–148; VF1:306–308; VF2:117–118).

The evident academic purpose is a requirement that must be carefully balanced with enjoyment of the product. The researcher received conflicting responses regarding this topic (sometimes from the same participants). EF4 (172–174) explains that the product “needs to serve the purpose of learning” in order for it to be considered “useful”, and that the facilitator needs to understand what the product is being used for. TF2-2 (114) echoes this by stating that “at the end of the day, I must know how it’s...
helping me and what it’s supposed to achieve”. This consideration is further discussed in the next section in its capacity of pertaining to the needs of the primary users.

There were two conflicting views regarding the researcher’s overall approach to designing the product. E3 (321–322) and EF2 (238–243) believe that appealing to the secondary users is almost more important than appealing to the primary users, as the facilitators influence purchasing decisions, and are responsible for actually using the product to facilitate learning, whereas the learners usually do not weigh in on these decisions. E3 (312–322) argues that facilitators thus need to find the product enjoyable, because if the teacher experiences no enjoyment from the product, they will not be encouraged to use it. This is in contradiction with TF3 (170–175), who believes that the product considerations need to focus wholly on the learners and their needs, and that the facilitators need to adapt to this. This leads to discussing primary user requirements.

4.5.4.3 PRIMARY USER REQUIREMENTS

Subsequent to discussing secondary user design requirements, the facilitators and key informants were asked what their learners’ specific needs as primary users of the educational toy are. As before, Graph 3 shows not only participants’ direct responses to this question, but also the requirements that have been identified and deduced by the researcher through analysis of, and reflection on, participant responses throughout the interviews. As can be seen in Graph 3, there were quite a number of high-ranking responses. The most prevalent primary user requirement is that the product should incorporate an element of kinaesthetic stimulation (or “doing something” (EF2:241–243; EF4:86–88)) (with 12 counts). This was closely followed by the requirements that the product should be fun and enjoyable to use, and that the product should easily understandable for users (ten counts each). The third and fourth ranking-tiers (nine and eight counts respectively) of primary user considerations were shared by the requirements that the product should be: aesthetically appealing, capable of capturing learners’ attention and engaging them, appropriate (or adaptable) to the various learning levels of the users, contextually relevant, not overtly academic, and visually and / or aurally stimulating. These ‘top priority’ design requirements are discussed in greater detail below, where it can be seen that the commonality to all these considerations are that they aim to engage the learners, and ensure they benefit from using the product.
As mentioned before, the ability to capture and retain learners’ attention long enough for them to learn ‘something’ is one of the challenges posed by the FP age group. The product therefore needs to be able to engage learners so they do not become bored or distracted, and this is primarily achieved by incorporating an element of kinaesthetic or tactile interaction, since a multisensory approach to learning encourages better concentration (E2:203–210,221–226; E3:97,240–242,353; EF2:241–243,265). Furthermore, if the learners are interested in engaging with the product, the facilitators are encouraged to engage alongside the learners (EF2:241–243). Further means of capturing learners’ attention link to some of the other design considerations that have been highlighted. If the product is fun to use, learners are likely to learn without necessarily realising it (EF4:70–71,184–186; VF1:321–325). Learners are also more prone to engaging with the learning activity if they find it enjoyable (E3:240–242,298,317–320), since “one of the main motivational forces in learning is ‘fun’, [and] without ‘fun’ children [do not] learn effectively” (EF1:223–224). Here, it must be noted that Holt (1983:119) advises that FP-aged children learn better if they are allowed to play and interact freely with items and materials, as opposed to if they have to follow set guidelines,
however this is not always conducive to a learning environment. Appealing to learners’ aesthetic sensibility, by incorporating bright colours and interesting illustrations or pictures, is another means of ensuring learner engagement, which is appropriate for learning environments. VF3 (119) believes that the most successful support resources depict “a lot of pictures”, as this appeals to all learners irrespective of their reading ability, and it especially appeals those learners whose abilities are very limited.

This leads on to the requirement that the product should be appropriate (or adaptable) to the various learning levels of the users; if the product it is too advanced or complicated, the learner will not engage with it, and they will lose confidence in themselves (E3:96–102; EF2:247–250; EF3:275–279 VF1:314–321). The product does, however, need to allow for an appropriate progression (in terms of learning), but this cannot be too fast as it will intimidate the learner (VF1:314–321). In order to build learners’ confidence, the product should allow the weak learners the opportunity to succeed at it, while also stimulating the stronger learners (EF2:249–250). TF2-2⁹ also explained that when she conducts group activities, she divides learners into groups according to their abilities, and that the product should be able to accommodate or adapt to these incremental levels. However, EF1 (193–196) believes that this is unattainable, and that the product should rather target a specific learning level, since learners who are at different levels cannot necessarily benefit from the same resource. Furthermore, the nature of the activities that learners enjoy depends on their reading and language capabilities (EF1:208–215; VF2:169–171); weaker learners prefer non-academic interactive activities, whereas stronger learners do get greater enjoyment from reading, or more academic activities, as it feeds their sense of achievement and self-confidence (VF2:171–177). As such, the researcher would do well by either targeting a specific learning level, or by allowing for a certain degree of modularity.

It is also necessary to comment on the related requirement that the product should not be overtly academic. According to EF2 (247), “so much about [the learner’s] life is challenging” already, that they thrive off the opportunity to enjoy themselves. The opportunity for entertainment does, however, need to be balanced carefully with the secondary users’ requirement that the product should demonstrate an evident academic purpose. Likewise, E3 (99–102), EF1 (220–223,230–232) and VF1 (150–151,308–309) believe it important that the learners themselves recognise the relevance of the game as it pertains to their own learning of literacy, and that the learners understand how the toy is reinforcing what they have already learnt. E1(289–290), however, believes that the purpose of the educational toy can be made evident, without it being overtly academic.

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⁹ Mentioned during discussion while TF2-2 was showing the researcher her self-made resources, not during formal interview.
In order to encourage sustained engagement, the product needs to be easy to follow and understand (E1:312–317,324; VF3:151–154), while still posing a suitable challenge (VF3:154). Learners tend to get bored and distracted if they do not understand a topic or activity (EF3:275–283) – both when the topic is too intellectually advanced, or when learners simply do not understand enough English. Ensuring the understanding of the product is also reliant on contextual relevance. The product must be based on images or concepts that are familiar and easily recognisable (EF3:49–51,138–142,148), and should ideally build on game-play, activities or resources with which the learners already have experience (VF1:211–217).

4.5.4.4 ADDITIONAL REQUIREMENTS

Through analysis of the interviews, the researcher was able to deduce a number of additional design considerations. These were not necessarily overtly mentioned as design requirements by participants, but transpired through their responses to some of the other interview questions. These have been recorded in Graph 4, and have been categorised according to ‘general considerations’ and ‘language-specific considerations’, and the most prevalent considerations are discussed below.

Graph 4: Stacked bar graph indicating participant feedback (according to sample group) regarding additional and language-specific considerations.
(Graph by author 2017)
The incorporation of pictures supports the aforementioned consideration for aesthetic appeal (which could refer only to the design aesthetic or use of colour), and would add to the product’s ability to engage a child. Similarly, the inclusion of a competitive element would also enhance a learner’s involvement with the learning activity. The requirement of the product relying on a simple core concept echoes the aforementioned consideration for being easily understandable, and for drawing from precedents with which the learner may already be familiar. TF2-1 (263–279) provided the example of Cuisenaire Rods (see Figure 36), which are a very simple mathematics learning aid. The product consists of a set of rods\(^{10}\) of various lengths and colours, but with no instructions, which means both teachers and learners can manipulate the components to do “all sorts [of things]” (TF2-1:272).

![Figure 36: Example of a Cuisenaire Rods set available at S2. (Photograph by author 2017)](image)

The simultaneous development of multiple skills through one product had mixed responses. Although many participants were supportive of this notion (for instance, the development of fine motor skills, problem-solving skills, and social skills), E3 (286–288) did advise that FP learners’ play needs to be guided. At this age, learners need to be encouraged to actively learn a skill and because of this, the toy should explicitly focus on language development, as opposed to addressing the development of other skills (E3:288–291). The product should also allow for versatility, or to be used in more than one way; not only will this allow the product to teach different skills, or address different learning levels, but it will also allow for use in different contexts (for instance entertainment, introducing new skills, remedial teaching, reinforcement of concepts, and one-on-one as well as group use) (E1:312–325).

\(^{10}\) A magnetised version is also available (TF2-1).
The language-specific design considerations were relatively straightforward. These considerations reflect the three most prevalent learning difficulties that stem from a limited exposure to English, and therefore, the researcher would do well to focus the design of the educational toy around one or more of these topics (vocabulary, comprehension, or sound development). E3 (337–349) advises that these topics (vocabulary in particular) are best developed through repetition, but because repetition can get boring (VF1:126–129), the product needs to be fun and should offer variety in some way, so the children do not mind the repetition.

4.6 PHASE 5: DEVELOPING DESIGN REQUIREMENTS

The evaluation of findings and resultant reflection on Phase 4 allowed for a thorough, holistic understanding of the research problem and research gap which led to Phase 5 during which a set of specific design requirements was established as was stipulated in the general design brief (4.2). The design requirements were based on the identification of trends and similarities between the primary and secondary data, and were also influenced by the researcher’s heuristic reflections and deductions, based on her expertise as an industrial designer.

As is typical with an industrial design approach, the design requirements span and connect a number of disciplines including product design, education, additional-language acquisition, and user needs. The design requirements stipulate the needs, conditions and constraints the final design intervention must address in order to attempt resolving the identified problem. Where the previous phase evaluated of the ‘present state of things’ through analysis of the primary research, establishing the design requirements planned the procedure of the product’s development, in line with Routio’s (2007 ‘How to create theory of design’) theory of design. This set of requirements determined the design direction of the proposed intervention, and was used as a basis for the design conceptualisation. These requirements were later also used to evaluate the success of the final product (Phase 9). The design requirements were developed by addressing specific needs for both primary and secondary users, and have been delineated under the following categories: design requirements for usability, functionality, learning and language, and physical and visual design requirements.

4.6.1 DESIGN REQUIREMENTS FOR USABILITY

Usability refers to the degree to which “a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use” (ISO cited by Clench 2013). The usability of the end product is essentially determined by the users. In order for the educational toy to support language acquisition effectively, efficiently and satisfactorily within the SA learning environment, for both primary and secondary users, the following design requirements need to be taken into account:
– Both learners and facilitators should find the product **understandable**, which means that it should preferably be based on a **simple and familiar concept**. As the onus rests on the secondary user to encourage conversation, ensure correct usage of the product, instruct the play-activity, provide the context and facilitate learning, the **instructions need to be easy** to understand and explain, because the facilitator cannot consistently re-explain the rules to learners, or interfere with their play. If the product can be understood quickly, it can almost immediately be put into practice, thereby saving valuable class time. Being understandable also means that learners are able to use the product independently; not necessarily in isolation, but without constant supervision and interference from the facilitator. Furthermore, one cannot assume that learners – especially those from disadvantaged backgrounds – are familiar with ‘common’ or traditional toys or game-play (for instance, dice or snakes and ladders). Basing the design intervention on an **archetype** would make it less intimidating to learners and would allow for quicker uptake on understanding. Familiarity does, however, need to be balanced with learners’ appreciation of new and novel resources and activities, for example, the product can incorporate familiar elements (from classic games or toys) in a new and novel way.

– The product needs to offer **variety** for both facilitators and learners, as both users can get bored with repeating the same activity, and learners can memorise patterns and words. Each interaction with the product should offer learners the opportunity to learn something new, or to build on what they have previously learnt.

– The product should appeal to both learners and facilitators, and be **enjoyable to use**. If learners enjoy using the product, they are more likely to benefit from the academic support; and if facilitators enjoy using the product, they are more inclined to use it to support their teaching, and their enthusiasm for the product can influence how learners respond to it.

– The product, and learning aspect, should be **play-based**; however, the **educational value of the product must still be evident** to both primary and secondary users. The product should also consider the advantages and disadvantages of implicit as opposed to explicit learning (respectively, learning by chance, and learning intentionally) (Jackson, McKay, Murray, Pretorius & Spaull 2016:13), although it must be noted that learners are less aware that they are learning when they are having fun (implicit learning).

– The product should **incorporate creative, imaginative, multisensory, manipulative, or social play**. Along with contained physical play (or the requirement for kinaesthetic stimulation), these were the most popular options for types of play to be incorporated in the educational toy. Guided imaginative play in particular allows for opportunities to build
sentences, practice comprehension, stimulate conversation and introduce new vocabulary. Imaginative play also helps build learners’ confidence, and prohibits repetition and the resultant boredom.

4.6.2 DESIGN REQUIREMENTS FOR FUNCTIONALITY

Functionality refers to the ability of a product “to perform according to a specifically defined set of parameters” (Clench 2013). Whereas the usability of the product is determined by users through their experience with the product, the functionality of the product is determined by the researcher through her expertise in the field of design. Although these requirements are still based on user needs, these conditions are critical to ensure the success of the end product. The design requirements that determine the parameters that ensure the functionality of the design intervention, and thus determine the concept direction, are as follows:

- The product needs to adapt to its context of use; whether this is the constraints of teaching in a classroom, or those faced by one-on-one teaching sessions. This includes being adaptable to various time constraints, offering versatility in terms of learning context, and being scalable depending on the number of learners who interact with the product.

- Although the key aim of the product is to support language acquisition in a fun way, the success of the product relies on its ability to engage learners. Although FP learners are able to follow simple rules, they “are still easily distracted and lose interest quickly” (Boucher 2008:237). Maintaining learners’ attention can be encouraged by incorporating kinaesthetic stimulation, or by including an element of chance, or anticipation, or by appealing to learners’ competitive nature. Furthermore, in order to capture learners’ attention, the product should appeal to learners’ inquisitive nature by capitalising on activities or elements that children are not exposed to on a daily basis, or that they find novel.

- The product must reflect considerations for the South African context. This includes making allowance for:
  - learners who have been promoted irrespective of not being academically competent, and thus have a limited capacity for literacy and the additional language;
  - inadequately trained teachers who may not be familiar with non-traditional LTSMs;
  - overcrowded classrooms;

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11 By incorporating the element of chance, the playing field is leveled in group situations, as the ‘winner’ of the game is not determined by the strongest or most competent learner, but by luck.
12 Younger children also benefit from non-competitive games, where the rewards are intrinsic (Boucher 2008:237).
> schools and learning environments having limited access to resources (such as computers, libraries, internet, electricity, etc.), thus making a low-tech toy most appropriate;
> learners’ parents having a limited education and being unable to assist learners with homework;
> learners being affected by the difficulties that result from poverty;
> and the country having 11 official languages.

– In order to be relevant to as many children as possible (bearing in mind the previous requirement), the product must reflect universal design principles (inclusive design). As mentioned in the Literature Review, when solutions are designed around the criteria of those who are “hardest to reach” (like weak learners, or learners from disadvantaged backgrounds), as opposed to those who are “easiest to reach”, the results are more effective and more extensive (UNICEF 2014a). This way, the product is most likely “to fit the broadest range of people and applications” (Lueder 2008:849). Universal Principles of Design by Butler, Holden and Lidwell (2003) acts as a guide to incorporating appropriate theories in order to increase the “probability that a design will be successful” (Butler, Holden & Lidwell 2003:11).

– The product (and its packaging) should be affordable, in order to reach as many classrooms and learners as possible. The cost-to-benefit ratio needs to be justified, and the materials and manufacturing processes need to be considered accordingly. It is also important to remember that, depending on the design of the resource, more than one maybe be needed in a classroom environment.

– The product should be accompanied with descriptive information and guidelines for use. Although FP learners learn faster if they are allowed to play and interact freely with items and materials, as opposed to if they have to follow set guidelines (Holt 1983:119), this is not always conducive to a learning environment. When introducing any learning device into the classroom it is also crucial that teachers understand their role in facilitating the learning process, as the product is likely to support a non-traditional method of teaching that teachers are not familiar with. As mentioned before, the absence of LTSMs from classrooms is a barrier to learning, however their presence can also be a hindrance if they are used in an irresponsible or incoherent manner that inhibits understanding and the learning process (Fleisch 2008:96,122; DOE 2003:38). The proposed intervention thus needs to be used effectively, and cannot merely ‘be present’ in the classroom. Providing instructions or guidelines alongside the product should prevent misuse.
- The product must be **age-appropriate** in terms of its size, physical complexity, cognitive demand, visual design, learning content, social implications and appealing to play preferences. The stipulated age group is 6–9 years, and a successful product should address preferences and learning capacities across the entire age spectrum.

### 4.6.3 Design Requirements for Learning

As an educational toy, it is crucial that the product supports learning in some capacity. The design requirements to ensure successful learning are as follows:

- The product should incorporate scaffolding or incremental learning. Learners cannot be encouraged to learn too quickly, as they find this intimidating; instead, learning needs to happen in small, incremental steps that are non-threatening. The product should preferably support learning as it is defined by MacBlain (2014 ch.1 sect.3), whereby understanding is generated by “linking existing knowledge to new incoming information”.

- The product should be adaptable to individual learning needs. Learners do not learn at the same pace, and they respond differently to different stimuli (Gulland & Phillips 2008:803). As Gulland and Phillips (2008:804) describe it: “[e]ach student learns different things from different people at different times in different places in different ways”, and the product needs to accommodate such differences.

- The product should support learner development. Children grow physically, cognitively, emotionally, and socially, and the development of all these aspects needs to be supported during the child’s interaction with the design intervention. Furthermore, the product should support the development of other skills in tandem with the development of language or literacy, although these should not be prioritised. This could include coordination, fine motor skills, problem solving skills, or creativity, however primary findings point specifically to the need for developing social skills and self-esteem.

### 4.6.4 Design Requirements for Language Development

Since the need that was identified and described in the design brief (4.2) requires that the educational toy supports the acquisition of an additional language (primarily English), the following design requirements should be adhered to:

- The design intervention should complement the DBE’s curriculum, and reinforce what children are learning. In order to teach reading, the DBE (2011b:14,16) stipulates that educators need to focus on phonemic awareness (recognising that speech consists of a sequence of sounds), word recognition, comprehension (engaging on various levels of
thinking), vocabulary and fluency. And in order to teach writing, the DBE (2011b:18) specifies that learners need to first communicate through pictures, and then progress to letter formation, word creation and finally the compiling of full sentences. It is important that basic writing skills (letter formation) are taught in tandem with basic reading skills (phonics), as both have a major impact on a child’s literacy ability (DBE 2011b:15,16). The product should also reflect similar considerations as those prescribed to the development of FP learning programmes or LTSMs. These include consideration for: the language competence of the learners; level of ability across the class; learning outcomes; content and context that are age-appropriate and address learner needs; allowing for both remediation and enrichment; capturing and maintaining interest; time allocation; barriers to learning; and avoiding bias and encouraging positive attitudes towards diversity (DOE 2003:37,52–53).

The design intervention should specifically be based on phonemic development or vocabulary building. Alongside comprehension (which can only be practiced, not ‘taught’), primary research findings showed that these were the areas of language development that have been found to be most problematic for FP learners. Although the exceptions to, and variations of, sounds in the English language seems to be one of the biggest stumbling blocks, focusing outright on this immediately makes the product irrelevant to the learning of any other languages. The building of vocabulary, however, poses much greater opportunity for a cross-lingual learning platform, and there is a far more viable opportunity to translate the end product. Furthermore, all learners can benefit from a better vocabulary, regardless of their other abilities or limitations. However, if the product does focus on introducing vocabulary, it is important that new words are discussed and used in the appropriate context.

The product should incorporate multisensory stimulation in order to reinforce language learning. By focusing on teaching literacy through reading, writing, speaking, listening and playing, the learning topic or content is reinforced, and greater concentration is encouraged. Although it is unrealistic to stimulate all the senses through one product, the design should consider stimulating more than one.

4.6.5 PHYSICAL DESIGN REQUIREMENTS

In order for the product to be successful, it is required to conform to certain physical and performance design requirements. The following physical and performance characteristics were identified:

The product must be safe to use, for both primary and secondary users. The safety aspect of the proposed product needs to be prioritised, and should dominate all other design considerations, yet this is unlikely to conflict other considerations (Routio 2007 ‘Product Safety’). Safety aspects include consideration for unintended use of the product, component
size and design, material choices, guidelines of use, adult supervision and necessary warning labels.

– The product must be appropriate to the physical capabilities and restrictions of the primary users, and must be **comfortable to use**. To achieve this, *The Measure Of Man and Woman* by Tilley (1993) provides\textsuperscript{13} reliable anthropometric data that is used to guide the design of the final product, in terms of physical constraints. Furthermore, the ergonomics of the product are essential, since a product that is uncomfortable to use will be unsuccessful, regardless of how well it supports learning. Aspects such as product material and texture, visual and aural stimulation, clarity and legibility of written elements, surface finishes, and rounded edges need to be considered.

– The consideration for kinaesthetic stimulation relies on tactile interaction with the product, which means that the product must be **easy to clean**, and that it must be **durable** in order to endure extensive handling and unintentional impacts. Not only do these requirements affect material choices, but they also affect the design decisions.

– The product should consist of as **few components** as is necessary, and if any components are lost or damaged these must be easily and inexpensively replaced, or the product must still function without these. **Minimal maintenance** should be required.

– The product must take into account **storage and space limitations**. Depending on the context within which it is used, the product may be restricted to use on a desk, and storage space is likely very limited. Linking to the aforementioned considerations for universal design principles, designing for the most restrictive situations allows the product to be conducive to the widest range of contexts. The **physical management** of the product should also be considered: the interaction with the product cannot be chaotic; the product should be easy to set up, as well as pack away; and manipulation of product components should not hinder interaction.

– The product should present an opportunity for **modularity**, in order to address more than one learning level, learning style, or learning context (group context, supported individual context, or isolated individual context). Considerations for modularity would also support

\textsuperscript{13} As mentioned before, due to the unavailability of suitable anthropometric data regarding the SA child population, this study relies on international data, and makes adjustments towards the lower percentile population in order to accommodate for growth stunting (due to malnutrition, which affects a substantial number of children in the country).
incremental learning. The versatility that is presented through modularity should, however, be carefully assessed, as attempting to ‘design for all’ might result in ‘designing for none’. 

– The design development is also obliged to consider the environmental impact of the product’s manufacture and use, but this is measured against the product’s affordability and accessibility. The sustainability of the product can be considered in terms of materials and manufacturing processes, recyclability, use of waste materials (for instance, using bottle tops as counters), product distribution, and the product’s longevity and life cycle.

4.6.6 Visual Design Requirements

In order for the product to be successful and appealing to users, it is also required to conform to certain visual and aesthetic design requirements. The following visual characteristics were identified:

– The product must be **visually stimulating and aesthetically appealing**. FP learners are particularly drawn to resources that display bright colours and bold graphics. Colour symbolism and psychology should be considered, and it is important that the use of colour does not discourage learner interaction due to gender bias.

– The product must **incorporate illustrations, icons or pictures**, as this is conducive to supporting language learning irrespective of a learner’s reading capabilities.

– The learning material that is represented on the product (words or images) must be **relevant to the South African context** and the learners’ frame of reference. This requires sensitivity to: political history; diversity of race, culture and religion; and the dichotomy of the educational and socio-economic distribution (for instance, learners who are from high and middle socio-economic brackets have positive responses to the word ‘dog’, however learners from lower socio-economic brackets may respond fearfully (E1:102-109)). Subsequently, the impact of these factors on the representation and relevance (historical, cultural, geographic, and social) of images, vocabulary and other content needs to be treated carefully.

– With regard to the use of text, consideration needs to be made for the following:
  > children do not like to read superfluous text;
  > any text must be represented in lowercase letters, not uppercase letters;
  > a sans-serif font that reflects the common representation of letters must be used (‘a’ as opposed to ‘a’);
  > and accompanying an image with a written word may result in image-identification as opposed to reading.
4.6.7 OVERVIEW OF DESIGN SPECIFICATIONS

The chart below (see Figure 37) provides a summary of the design requirements that have been identified to guide and assess the design of an educational toy to aid with supporting the acquisition of an additional language (primarily English) in the FP, whilst bearing in mind the SA context. The educational toy must be designed in such a way that it is both usable (determined by users) and functional (determined by designer), that it supports learning and language acquisition, and that it fulfils physical as well as visual requirements.

![Figure 37: Overview of design requirements that need to be considered for the design of an educational toy.](Chart by author 2017)

In order for the end product to be deemed successful within the constraints of this study, the product needs to evidence consideration for these requirements. As such, these six conditions have been delineated accordingly in Figure 38 to aid the design decision-making process. Although unlikely to conform to all considerations, the end product must prioritise a significant number of these, and justify the decisions accordingly.
Figure 38: Hierarchical outline design requirements that need to be considered for the design of an educational toy. (Chart by author 2017)
Phase 6 encompassed the first design iteration and the first ‘action’ cycle. The design requirements identified in Phase 5 fed directly into the design conceptualisation. The various sources of research – literature, collected data and heuristic research – were combined in the design phase. Visual research, presented as research boards, also influenced conceptualisation. Initially, preliminary concept sketches displayed a variety of possible design solutions whereafter the researcher used her own judgement and expertise to select four design directions for devices that had the best potential for addressing the problem, and these were further explored through sketches and block models. These four concepts were presented to the participants for feedback. This represented the second round of field research. Although participants provided valuable insight and feedback, they were at no point directly involved with the design process. This concluded the sixth phase of the design process and the subsequent analysis of the user feedback indicated the start of the second design iteration (Phase 7).

4.7.1 DESIGN DIRECTION VISUALISATION

Prior to commencing with the exploration of different design directions, the researcher compiled visual research boards. The first board (see Figure 39, left) depicts the precedents that were discussed in 2.5, and the second board (see Figure 39, right) portrays additional visual research that was used to support the first design iteration. Where the first board depicts the existing language development resources according to activity categories, the second groups examples of resources according to product characteristics (such as: material, use of colour, and iconography). Both of these boards allowed the researcher to draw inspiration with regard to activity and game-play, physical product form, and visual appearance. Scaled versions of all research boards can be found in Appendix E.

Figure 39: Visual research boards compiled by the author to support the design conceptualisation phase. The Precedent Board (left) provides examples of support resources according to play categories; and the Visual Appraisal Board (right) sorts support resources by product characteristics. (Boards compiled by author 2017)
4.7.2 CONCEPT IDEATION

Using the identified design requirements and research boards as a starting point, the researcher commenced with the exploration of various concept directions. As can be seen in the selection of example sketches in Figure 40, the researcher initially explored design directions through written notes, whereafter various concepts were sketched. Some of these were of the researcher’s original design; some adapted existing products to support a language-learning context; and some combined aspects of existing precedents to target the identified research problem more specifically. This step was referred to as concept ideation, and resulted in divergent research, since the researcher developed a wide range of potential design solutions.

Figure 40: A selection of sketches that were produced during the concept ideation stage.
(Sketch pages by author 2017)

4.7.3 CONCEPT EXPLORATION

In order to narrow the focus of the design conceptualisation (and thereby indicate convergent research), the researcher used her own heuristic judgement and expertise to select four of the abovementioned design directions for further exploration. This decision was based on selecting the concepts that the researcher believed had the most potential for addressing the research problem, whilst meeting the identified design requirements. The four design directions that were further explored were: a dice-based story builder, a tile-based story builder, an identification game, and a
set of language-based construction blocks. The four concepts were considered in terms of their physical form, the game-play or activity that they would involve, and the content that they would display. The four concepts were represented through notes and sketches, block models, and visual renderings. However, since this was still an early stage in the product development process, these models and renderings were intended to portray only a general idea of the concept. These were meant to support the decision-making process of determining the type of resource that would best support language learning; they were not intended to be indicative of the end product.

The four concept directions are discussed below. Each discussion starts with a description of the product, its intended use, and identifying its educational potential. Early on, the researcher recognised that the success of the design intervention would depend on its suitability for the SA context, and subsequently decided to focus on designing a low-tech resource. Additional considerations for the suitability for the SA context (including durability, longevity, affordability, and contexts of use) were considered at a later stage in the product development process. Full sized renderings of concepts can be found in Appendix K.

4.7.3.1 CONCEPT 1: DICE-BASED STORY BUILDER

Concept 1 (C1) (see Figure 41) consists of a plastic base with a three-by-three grid, a transparent lid, nine dice, and six individual 'grid blockers'. The faces of the dice depict images or icons that are relevant to the SA context. The container is shaken to rearrange the dice, whereafter the learners are required to tell a story or build a sentence, using the displayed images as prompts. In group contexts, the learners can take turns to build sentences that tell a cohesive story. The ‘grid blockers’ make allowance for weaker learners who need to use fewer dice to complete the same activity. As learners progress, the image-dice can be supplemented with dice depicting words, letters or sounds. This product can also be used as a resource for facilitators to tell stories to their learners. This product relies on imaginative and creative play to support communication skills and vocabulary development.
4.7.3.2 **CONCEPT 2: TILE-BASED STORY BUILDER**

Concept 2 (C2) (see Figure 42) consists of a fabric drawstring bag, a variety of tiles, and two dice. The top face of each tile depicts an image or icon that is relevant to the SA context. The reverse face depicts a pattern that can be arranged to complete a puzzle. Players are required to roll the dice, and draw the appropriate number of tiles. The tiles that have been drawn are used as story prompts, or as aids to test vocabulary. In group contexts, the learners can take turns to build sentences that tell a cohesive story, or when testing vocabulary, learners can keep the tiles when words have been identified correctly, and the learner with the most tiles 'wins'. Additional tiles that depict written words, letters or diagraphs can be added as learners advance. As with the previous concept, this product relies on imaginative and creative play, as well as manipulative play to support communication skills, vocabulary development and fine motor skills development.
4.7.3.3 Concept 3: Identification Game

Concept 3 (C3) (see Figure 43) is a game that consists of five unique dice, a dice container, four ‘catching cups’, and a number of double-sided tokens that are attached to strings. The top face of the token depicts a contextually relevant image or icon, and the reverse face depicts the corresponding word. The dice represent the same words, as well as a variety of sounds, letters and categories. The number of dice that are used is determined by the learners’ literacy ability. Players are either ‘catchers’ (they receive a cup) or ‘evaders’ (they are assigned a number of tokens). Players are required to shake the dice container in order to roll the dice, whereafter ‘catchers’ need to capture the representative token, and ‘evaders’ need to pull the representative token away before being caught. By using more than one die, learners are given multiple opportunities to identify the correct token (for example, the word “star” can be matched with the image of a star, the letter “s”, or the sound “st–”). This game can be played in a one-on-one context (with one “catcher” and one “evader”), or in small groups (with multiple “catchers” and “evaders”). This concept relies on manipulative play, identification ability and quick thinking to match words and images, in order to support reading and problem solving skills.

Figure 43: Rendering of Concept 3, which is an identification game that supports language learning.
(Design and renderings by author 2017)

4.7.3.4 Concept 4: Construction Blocks

Concept 4 (C4) (see Figure 44) consists of narrow blocks of a variety of lengths, and a container in which they can be stored. The four long faces of each block depict a contextually relevant image or icon on one end, and a word on the other end. The blocks are used like dominoes to match words to images. This can be used in one-on-one or group contexts. Alternatively, each block can act as a story or sentence prompt. The blocks can also simply be used for construction play. This product relies on construction and manipulative play to support problem solving skills, literacy, and vocabulary development.
4.7.4 USER FEEDBACK

As described in the design process (3.3), each design iteration concluded by conferring with participants to gather feedback on the proposed design solution/s. During Phase 6, participants were approached with feedback forms that provided descriptions and depicted visual renderings of the product concepts, as well as physical block models of the concepts (see Figure 45). The participants were requested to provide feedback based on their understanding of the various concepts, which contributed to the ideographic normative approach described by Routio (2007 ‘How to create theory of design’), and indicated another divergent phase in the research. This feedback contributed to the investigation of the amelioration of the research problem through the design of a new product intervention. The research that was conducted during this phase is reported in Section 3.5.4.2.
4.8 Phase 7: Design Development

Phase 7 covered the second design iteration and indicated the second ‘action’ cycle. This phase started by collating and analysing the user feedback that was gathered during the last step of Phase 6. This data analysis played a crucial role in determining the concept that would be developed further. The researcher’s reflections on the data analysis cemented the decision of which design solution to pursue. Selecting and focusing on a single design direction indicated another convergent phase of the research. Guided by both user feedback and heuristic evaluations, the design solution was developed through sketches and block models, and prototype samples were produced. The development phase was supplemented with additional secondary research regarding material choices, manufacturing processes, and content development. Phase 7 concluded by again getting the users’ feedback regarding the proposed design solution. This represented the third round of field research, and the subsequent analysis of the user feedback indicated the start of the third design iteration (Phase 8).
4.8.1 DATA ANALYSIS

In order to facilitate the next design iteration, Phase 7 commenced with the analysis of the data that was gathered from user feedback regarding the four concepts. Through the analysis of this data, the researcher was able to identify the strengths and weaknesses of each concept (as evaluated by the secondary users), and by quantifying their opinions (through rating scales) the researcher was able to determine the concept that would be most beneficial for supporting language development in the FP. The data has been discussed in accordance with the various questionnaire sections: additional information regarding the general design requirements; respective feedback on all four concepts; and the concept that was regarded by participants as being most promising. The data in this section references the participant feedback forms and transcripts of all researcher notes from the conceptualisation phase, that can be found in Appendix J.

4.8.1.1 GENERAL DESIGN REQUIREMENTS

The first question that was posed, asked participants to choose (from the provided list) between five and eight design requirements that they considered to be the most important with regard to the design of an educational toy. By narrowing down the requirements that the users consider to be most important, the researcher was able to identify a list against which the end product could be evaluated. As can be seen from Graph 5, the following design requirements stood out as being the most important according to study participants: play-based learning (response count of ten), ease of use for learners, enjoyability (response count of seven for both), ease of use for facilitators, evidencing educational value (response count of six for both), being conducive to both individual and group use, durability, multisensory stimulation, understandability (all with a response count of five) and complementing the curriculum (response count of four). Although the other design requirements would not be disregarded (especially with regard to product safety and ergonomics), these ten considerations were to be prioritised during the next design iteration.

14 It must be noted that all column graphs that represent percentages that have been included in 4.8 have a minimum bound of 50% and a maximum bound of 100%. These have been clearly indicated on the relevant axes. This has not been done to mislead the reader. Contrarily, due to the nature of the data, this has been done in order to exaggerate the differences in ratings.
The second question asked participants what material they would prefer the educational toy to be made from. As can be seen from Graph 6, below, wood was the material that was preferred by the highest number of participants, however three participants indicated no particular preference (E3, EF3, EF4), and commented that the material choice ought to be determined by the nature of the toy, or that it should be driven by the cost of the product.

**Graph 5:** Stack bar graph indicating participant feedback (according to sample group) regarding design requirement prioritisation for the design of an educational toy to support language acquisition. (Graph by author 2017)
4.8.1.2 ANALYSIS OF CONCEPT 1

As can be seen in the feedback form in Appendix I, participants were required to rate provided statements as they pertained to the respective concepts, according to the extent to which they agreed with the statements (where 1 represented ‘strongly disagree’, 2 represented ‘disagree’, 3 represented ‘neutral’, 4 represented ‘agree’, and 5 represented ‘strongly agree’). These statements were categorised, and subsequently aggregated, by the researcher according to: enjoyability and engagement; understandability; usability; educational value; and variety and adaptability. Furthermore, the same statements were also categorised according to primary and secondary user considerations.

The resultant data for C1 is visually represented in Graph 7. The graph shows that the concept was consistently rated very highly across all categories, with only 4% fluctuation. C1 was rated particularly highly in the educational value and the usability categories (92%), but less highly in the variety and adaptability category (88%). On average, C1 was rated 4.52 out of 5 (90.3%), and when asked whether or not they would use C1 to support language teaching, all 13 participants said that they would\textsuperscript{15}.

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\textsuperscript{15} The only anomaly that transpired with the rating scales, was that VF3 rated C1 as 1 out of 5 for the first statement (relating to facilitators finding the concept easily understandable), however the remainder of her feedback for C1 was overwhelmingly positive. This leads the researcher to believe that this may have been an accidental rating, especially as VF3 had filled in the survey electronically.
Participants were particularly positive about the product’s potential for adaptability to learner levels and context of use\(^{16}\) (group and individual use) (E2, E3), the enjoyability it poses for learners (E2, EF2, EF3, VF3), and its ability to support learning (E2, EF2, TF2-2, TF3). E3 and TF1 also commented on the advantages of the game-play being ‘contained’ in the transparent dome, as this makes it easier to use and control. EF1 did, however, raise concerns about the product’s storage, elaborating that The Link has limited storage space available, and that the majority of existing resources are stored in A4 lever-arch folders.

Whereas some participants found this to be an innovative product (scoring an average of 4.08 out of 5), VF1 in particular was familiar with both \textit{Boggle} and \textit{Rory’s Story Cubes}. VF1 commented that although having images that are relevant to South Africa would benefit the product, she elaborated that “there would need to be additional block-sets to bring out [the concept’s] true value” and that level-specific ‘expansion packs’ would set this product apart from predecessors (corroborated by TF2-1). This, however, contradicted EF4 and VF2, who commented that the learners who attend The Link’s session would probably find working with the proposed nine dice too challenging, and with EF4 suggesting that using between one and three dice might be more suitable.

\(^{16}\) TF2-2 even suggested that C1 could be adapted to support mathematics learning.
In spite of the high ratings, when asked to rank the concepts in order of preference in the last section of the feedback forms, C1 was only selected as the first choice by three of the participants, and as a second choice by four participants. The three participants who selected C1 as their first preference (EF2, EF3, TF2-1) agreed that the product was conducive to use in educational as well as home environments, and also agreed that the product could be used in both group and one-on-one settings. Where EF2 and EF3 found that the product would be suitable for use in both short and long time slots, TF2-1 did not think the product would be able to engage learners for extended periods. This concept was chosen as the first preference by these participants because the product would appeal to and engage learners (EF2, EF3), and because of its practicality in a classroom environment (TF2-1). Participants identified that facilitating big groups (EF2, EF3, TF2-1), and the noise-factor of shaking the dice (EF2) would likely pose limitations to the use of the product.

4.8.1.3 ANALYSIS OF CONCEPT 2

The visual representation of the ratings received by Concept 2, according to the same categories as before, is represented below, in Graph 8. The C2 ratings show greater fluctuation (7%) across the various categories, with the enjoyability and engagement and the understandability categories receiving the lowest ratings (77% and 78% respectively), and with the usability and the educational value categories receiving the highest ratings (85%). When asked whether or not they would use C2 to support language teaching, only eight participants (62%) said that they would. Out of all four concepts, C2 received the highest number (five out of 13) of “no” responses to this question (see Graph 14), and this was reflected by C2 receiving the lowest average score, of 81.4% (4.07 out of 5).

Graph 8: Column graph indicating the rating (as a percentage) of Concept 2 according to various categories, as per participant feedback.
(Graph by author 2017)
C2 was greeted with limited enthusiasm from the participants. The main factors that contributed to negative feedback were that the product would be too challenging for learners to understand, especially if it incorporated parts of speech (EF1, EF4, VF2, TF1, TF3), that the opportunity for adaptability was limited (EF4), and that it would appear too academic in nature as it does not portray an element of fun (EF2, VF2, VF3). EF2 elaborated, explaining that C2 reminded her of *Bananagrams*, and that – in her experience – learners do not respond well to this resource, and would likely have a similar response when presented with C2. It should also be noted that a number of participants particularly stated that, although they would use the product, it would only be suitable for more advanced learners (E3, EF3, TF2-2). TF1 further commented that having multiple small components was likely to hinder product management, as tiles could easily get lost. Even amongst the eight participants who said that they would use C2, the general response was lacklustre, as is evidenced by the majority of users selecting C2 as a third or even fourth choice, and only one participant selecting it as a second choice.

4.8.1.4 Analysis of Concept 3

The visual representation of the ratings received by Concept 3, according to the same categories as before, is represented below, in Graph 9. C3’s ratings showed the most extreme fluctuations (17%). The enjoyability and engagement category was rated very highly (95%), but the understandability and the usability categories were rated relatively low (78% and 82% respectively). When asked whether or not they would use C3 to support language teaching, 10 of the 13 participants (77%) said that they would. Despite the two low ratings and the three negative responses, C3 still scored an average of 4.47 out of 5 (89.3%).

![Graph 9: Column graph indicating the rating (as a percentage) of Concept 2 according to various categories, as per participant feedback.](Graph by author 2017)
C3 was greeted with very strong mixed responses. Although C3 received a notable, but not overwhelming, number of “no” responses to the question regarding product use, the three participants who would not use C3 where vehemently opposed to it. Participants were either thrilled by the novelty of the game and the fun, competitive element that it posed (E2, EF4, VF3, TF3); or they were strongly opposed to the game’s complexity and the potential chaos that would ensue (EF1, EF3, TF2-1, TF3). The concept was also dismissed due to the number of components that would be required, and the potential of the cords breaking (E3). The researcher was also cautioned that the content that would be displayed on the dice and tiles, and the detail that would need to be captured on the dice, would need to be carefully considered (EF4, VF2).

With regard to positive feedback, TF1 elaborated that the game enabled learning to cross the midline of the brain, thus allowing cognitive development of both the left (analytical) and the right (creative) hemispheres of the brain. C3 was also commended for developing fine and gross motor skills, response time, hand-eye coordination, social skills, and problem solving skills (TF1, TF2-2, TF3). Furthermore, even participants who could not see themselves using the product rated the product very highly in terms of engagement and enjoyability for both primary (4.92 out of 5) and secondary users (4.77 out of 5), and the competitive element was identified as crucial for maintaining learner engagement.

C3 was selected by five participants as their first choice of educational toy, and by only two participants as their second choice (54% in total). The five participants who selected C3 as their first preference did so because of its innovativeness (VF1, VF3), the excitement and enjoyability factors (VF2, VF3, TF1), and its potential for expansion and adaptability (VF1, TF1, TF2-2). Possible limitations identified by participants included the cord breaking (EF4, VF1, VF2), space requirements (VF3), and noise generation (VF3). Of the five participants who selected C3 as their first choice, all concurred that the product was conducive to use in educational as well as home environments, and all agreed that the product could be used in both group and one-on-one settings (VF1, VF2, VF3, TF1, TF2-2). The majority of the participants identified that the product would only be suitable for use in short time slots (VF1, VF2, VF3, TF1), with TF2-2 being the only participant who believed that the product could also be used in longer time slots.

4.8.1.5 ANALYSIS OF CONCEPT 4

The visual representation of the ratings received by Concept 4, according to the same categories as before, is represented below, in Graph 10. As with C1, C4 showed consistently good ratings, with only 5% fluctuation across categories. C4 was rated highest in the educational value category, and rated lowest in the variety and adaptability category. Although C4 was rated quite highly across all categories and received an average rating of 4.37 out of 5 (87.5%), it did not achieve ratings as high as those of C1 (which achieved an average of 90.3%). When asked whether or not they would use
C4 to support language teaching. 12 of the 13 participants (92%) said that they would, and only one said that she would not.

The majority of participants responded to C4 with enthusiasm, as is evidenced by E3’s simple response: “Best option! Love it!”. The simplicity of the product offers “endless possibilities” for gameplay (E2), and its potential for adaptability was especially prominent amongst participants’ reasons for seeing themselves use the product (E2, EF1, EF2, TF2-1, TF2-2, TF3). The only participant who stated that she would not use the product was TF1, who elaborated that she thought the product would be more conducive to use in a one-on-one setting, as opposed to the classroom environment in which she teaches. Contrarily, although she responded that she would use the product, EF3 (who does facilitate on a one-on-one basis) thought the product was more conducive to use in a group context. TF1 was, however, still complimentary of the product, stating that it would contribute to the development of learners’ fine motor and social skills. A notable concern that was raised was that the storage of C4 could be potentially problematic (EF1). There was also mention of the product not being as enjoyable to use as C3, due to the more passive nature of the game-play. However, the tactile element of manipulating the blocks, and the content of the blocks, were regarded as promising with regard to learner engagement (EF1, EF2). This being said, VF3 did express concern that learners might “construct things with the blocks rather than [use] them for … vocabulary development”.  

Graph 10: Column graph indicating the rating (as a percentage) of Concept 4 according to various categories, as per participant feedback. (Graph by author 2017)
Although C4 was rated lower than C1 in all categories, this concept was selected as the first preference by five participants, and as a second preference by six participants\(^{17}\) (84\% in total). The five participants who selected C4 as their first choice did so because of the product’s ability to support a variety of learning activities (E2, E3, EF1, EF4, TF3), the balance of enjoyability and manageability posed by the intended game-play (EF1, EF4), and the product’s ability to support the development of logical thinking and creativity (TF3). Although the response to C4 was overwhelmingly positive, participants identified a number of limitations that may be faced with the product, including: the creativity of the secondary user with regard to product use (E2, E3, EF4); durability, simplicity, and size of the storage solution (E3, EF1); and the number of blocks that are required to accommodate all reading levels (EF4). Among the five participants who selected C4 as their first choice, there was general consensus that the product could be used in both home and classroom environments, and in both group and one-on-one contexts (E2, E3, EF1, EF4, TF3). Although these five participants agreed that the product was conducive to use in short time slots, only three of the five (E3, EF1, TF3) believed that the product could also be used in longer time slots.

4.8.1.6 Preferred Concept Direction

Determining the preferred concept direction was more challenging than the researcher had anticipated. When the aforementioned graphs indicating the categorical ratings of the respective concepts are combined (as can be seen in Graph 11) it is evident that each concept has its own strengths and weakness. Most notably, C3 was rated both the highest (95\% in enjoyability and engagement) and nearly the lowest values (78\% in understandability) across all categories. And, with the exception of the usability category, C2 was rated the lowest in all categories. C1 and C4 were both rated relatively highly, consistently, with C4 being rated 3\%–4\% lower than C1 in most categories. It can also be seen that – with the exception of C2 – the primary and secondary user considerations were rated very evenly for each concept.

\(^{17}\) The remaining two participants did, however, select C4 as their last choice.
When the four concepts are compared on a basis of averages\textsuperscript{18}, as indicated in Graph 12, it is evident that, from highest to lowest ranking, the order of concepts is: C1, C3, C4 and then C2. However, even though C1 was rated the highest according to the rating scales, it is only marginal, as there is only a single percentage difference between C1 and C3, and an additional 1.8\% difference between C3 and C4. With no clear outlier, it would be dismissive to decide on which concept to pursue based on this data alone. The only evidence that can be accurately deduced from these findings is that C2 is definitely the lowest ranking concept.

\textsuperscript{18} It must be noted that in order to determine concepts’ average ratings, each rated statement was weighted equally, but that this does not mean that all categories were weighted equally, since the categories were not necessarily comprised of the same number of statements.
Graph 12: Column graph indicating the average rating (as a percentage) of each concept, as per participant feedback. (Graph by author 2017)

The data of average ratings that is represented in Graph 12 is, however, somewhat misleading. Although Graph 11’s clustered column graph provides a good indication of how each concept is rated according to various categories, it is difficult to deduce how the concepts compare to one another on the whole (not on average). The radar graph depicted in Graph 13 shows the same data that is represented in Graph 11, but provides a more holistic view of how the concepts fare. An ‘ideal’ product would score 100% on each spoke (category) of the radar, thus forming a perfect pentagon. When looking at Graph 13 it is once again evident that C3 was awarded the highest rating in a single category (enjoyability and engagement), however the distorted pentagon that is formed when connecting the individual category markers of C3’s rating, indicates that the concept is lacking in some respects (in this case, the understandability and the usability categories). Conversely, when looking at the pentagon that is formed by C1’s radar, the more uniform shape is testament to the concept being more well-rounded, in spite of being rated lower than C3 in the enjoyability and engagement and the variety and adaptability categories. The slightly smaller, but still uniform pentagon that is formed by C4’s radar, echoes that C4 is a well-rounded concept, but that it does not fare quite as well as C1 does.
Based on the evidence in Graph 11 and Graph 12, coupled with participants’ responses to being asked whether or not they could see themselves using the products (see Graph 14), one would assume that C1 – as the highest scoring, and most well-rounded concept – was the participants’ preferred educational toy (with all participants seeing themselves using the product). Although C3’s average rating might have been the second highest, Graph 13 showed that it was an imbalanced concept, and Graph 14 shows that three participants could not see themselves using the product. In lieu of this, it would lead to the deduction that C4 would be the second preference of educational toy, as it is also a well-rounded concept, and only one participant was unable to see themselves using the product. However, as is explained below, this was not the case.
Although the rating scales were very useful for determining the areas where the individual concepts were meeting, or falling short of, participant expectations, the participants had not been explicitly asked to rate each concept in comparison to the other concepts. This means that, although C1 was rated highly in terms of being the most well-rounded product, it was not necessarily the preferred concept. In the last section of the feedback forms, participants were specifically asked to rank the four concepts based on the criterion of being the most successful in supporting the learning and teaching of a language. Participant responses have been captured in Graph 15.

**Graph 15:** Stacked bar graph indicating participant preferences for each concept, based on response count (indicated in bar end) to each ranking. (Graph by author 2017)

Graph 15 shows how the various concepts fared when ranked according to preference. Here, it can be seen that C1 was predominantly a secondary or tertiary preference, whereas C4 was predominantly a primary or secondary preference. Unsurprisingly, C2 was overwhelmingly a tertiary or quaternary preference, even with participants who could see themselves using the product. C3, however, was either a first or a last preference to most users, showing the dichotomous responses that this concept elicited. Although Graph 15 is undoubtedly helpful in ascertaining the preferred concept, Graph 16 provides the most accurate representation thereof. Graph 16 essentially depicts the same data that was captured in Graph 15, however, participants’ responses have been weighted\(^\text{19}\).

\(^{19}\) First choices were weighted as 4, second choices were weighted as 3, third choices were weighted as 2, and fourth choices were weighted as 1.
When looking at Graph 16 it is evident that C4 can be deemed the concept that ought to be developed further. Although the same number of participants chose C3 and C4 as their “1st Choice”, the high number of “2nd Choice” responses received by C4 boosted it into the first position, whereas the number of “4th Choice” responses received by C3 weighed against it. In spite of the heavily contrasted opinions regarding C3, it does, nonetheless, tie with C1 as the overall second preference.

4.8.2 REFLECTION

Prior to commencing with the development of a concept, the researcher reflected upon the data findings, as well as the notes she had taken during the interviews. Instead of indiscriminately following the data as one might during a quantitative study, action research allowed for a more open-minded approach to what can be considered data, and thus granted the researcher the opportunity to analyse her own “judgements, reactions and impressions” in order to make a better-informed decision (Cohen et al. 2005:229). The opportunity to incorporate heuristic reflections was particularly pertinent to the design of an educational toy, as the participants’ feedback from an educational standpoint was balanced with the researcher’s design expertise. This section starts with a brief heuristic analysis of each of the four concepts, which provides the researcher’s complementary and contrasting interpretation of the concepts, as well as her reflection on participant feedback. Hereafter, the researcher deliberates the concept direction that was postulated by the formal data analysis, and makes a final, informed decision on which concept to develop further.
4.8.2.1 Reflection on Concept 1

Concept 1 aimed to capitalise on the opportunity for imaginative play, ease of use and understandability, the need for vocabulary development, and the enjoyment learners get from throwing dice (kinaesthetic stimulation). The noise generated by the shaking of the dice added an element of multisensory stimulation, but – as anticipated – some participants did warn that this posed the problem of being disruptive to others. However, the noise generated by the game-play could be reduced through the material choice of the dome and the dice, and although this would reduce the multisensory stimulation, the concept would still remain true to its original intention. The product also ‘contained’ the game-play, which would have made it more manageable for facilitators (as indicated by E3, TF1 and TF2-1), and was intended to provide an easy storage solution as the components are self-contained. However, this was not the case, as discussions with EF1 showed that the product could not be stored in the same system as is currently in use by The Link, and the domed top was not conducive to stacking multiple products.

C1 was quite evidently influenced by Boggle (Figure 20) as well as Rory’s Story Cubes (Figure 14). Those participants who did not have either precedent as a frame of reference found C1 very innovative, and thought it would be a valuable resource to have available. However, VF1 – who was familiar with both precedents – was concerned about what would set C1 apart from these (other than incorporating SA images), and was particularly adamant that ‘expansion packs’ that target different learner levels would be fundamental in distinguishing C1 from the precedents. Although the concept’s potential for adapting to time constraints, learner needs, and learning contexts was very well responded to, this topic of including expansion packs, and the number of dice used, proved to be an unexpected point of contention. The researcher, however, felt that the individual ‘grid blockers’ accommodated weaker learners (by limiting the number of dice used), and that the allowance for ‘expansion packs’ would support stronger learners, and provide greater flexibility. Furthermore, if the resource were used solely with image-dice, the product also has the potential to be used across all SA (and even foreign) languages, as images can be considered a universal resource. Additionally, due to the variety of content that could be portrayed each time the unit is shaken, the potential of repetition is reduced, and the risk of boredom – for both learners and facilitators – is minimised.

Although this concept could support vocabulary development in isolation, the story-building element is an important tool for engaging learners with a language, and encouraging use of their imaginations. EF4 was, however, concerned that the prospect of telling a story using all nine dice would be overwhelming for learners. VF2 also commented that learners might not be able to tell a story at all, and TF1 thought that the product might only be applicable to older learners (bearing in mind that TF1 teaches Grade 1 learners), which raises doubts about the product being useful across all FP grades. The researcher had originally intended for the resource to also be used by facilitators for story-telling (in a group context, or the third time slot of The Link’s sessions). However, EF2
cautioned that volunteer facilitators prefer being provided with instructions or following a predetermined game-play, and that the researcher should not rely on the volunteers to “do too much on their own”.

4.8.2.2 Reflection on Concept 2

Concept 2 bore many similarities to Concept 1, however this product offered learners variety in terms of being an unconventional resource (tiles as opposed to dice, which are more common), while still offering the opportunity for tactile stimulation and interaction. This concept did, however, run the risk of being less easy to contain and manage (E3, TF2-1 and TF1), and it did not pose the same level of anticipation or excitement as C1 did (EF2, EF3). The researcher believed that the use of tiles would render the product more flexible than C1, as it would offer greater variety and adaptability in terms of conforming to individual learner needs and different approaches to game-play, however the participants did not respond accordingly. Although VF1 believed C2 to be more innovative than C1, most participants felt that the C2 was restrictive and that this product would only be suitable for more advanced learners. What the researcher had identified as ‘flexibility’ evidently came at the compromise of C2 being viewed as a more academic resource that would be less enjoyable for the learners, to the extent that the concept was disfavoured by the majority of the participants. The researcher’s suggestion for coding the tiles according to parts of speech is what dissuaded most participants from supporting this product, and there were a number of suggestions to replace noun, verb and adjective tiles, with subject, verb and object tiles (which reflects content with which the learners are more familiar), or simplifying the product from a story-building resource to a word-building resource, and having vowel, consonant, and diagraph (sound) tiles instead. Due to the limited enthusiasm for the product, C2 received little constructive criticism.

4.8.2.3 Reflection on Concept 3

Concept 3 capitalised on learners’ enjoyment of competition and physical interaction with products. The researcher had expected mixed responses to this resource, but had not anticipated such a strong positive response. Based on the data analysis conducted during Phase 4, the researcher had anticipated that – although participants would recognise the enjoyability factor C3 posed to learners and facilitators alike – participants would be dissuaded from supporting this concept due to insufficient educational value, incidental as opposed to explicit learning, and the game-play being complicated and potentially chaotic. Although both the positive and negative factors were corroborated, participants remained enamoured with the concept, despite the potential challenges of controlling the game (for example, enforcing rules, or tokens becoming tangled), preventing possible cheating or bullying, and managing learners’ emotions. To a large extent, these challenges could merely be attributed to the limited social skills that children portray at the FP age, and instead of seeing this as a challenge, some participants identified this as an opportunity for learners to develop their social skills (through both cooperation and competition).
C3, undoubtedly, offers high levels of excitement and entertainment, but this came at the compromise of the game-play not being sustainable for longer time periods (as indicated by participants in the feedback forms), and although there is variety within the content, the nature of the activity does not lend itself to being very adaptable. Furthermore, as with Concept 1, C3 posed the risk of being disruptive to those in the vicinity due to noise generation. Although the game components would generate some noise (shaking the dice container, and the noise of ‘capturing’ tiles) the noise generated by the learners themselves during the excitement of the game-play was likely to be a more distracting factor. Unlike C1, the noise made by the learners as they win or lose could not be reduced through mere material choices, and attempting to control learners’ excitability through changes to the design of the game-play would alter the core nature of the concept.

4.8.2.4 Reflection on Concept 4

Concept 4 aimed to build on the language-development opportunities that are presented by construction play (see Section 2.5.3) – which falls under manipulative play – and also hoped to draw on facilitators’ own sense of nostalgia, by adapting a traditional ‘toy’ (wooden building blocks) to a language-specific purpose. C4 also addressed the requirement of kinaesthetic stimulation, but incorporated a cooperative – instead of competitive – game-play element which the researcher believed to be more conducive to contributing to the development of learners’ social skills. The more passive nature of the product interaction did, however, mean that the level of engagement posed by this concept remained questionable, and EF4 pointed out that C4 was lacking C3’s fun-factor and specifically suggested that the concept ought to include a “competitive element as it gives some point to the game”. EF3 raised a different concern with this product, in that it would be too time-consuming to mentally and physically ‘sort’ through all the faces for the matching word or picture, and that learners might become bored with this activity as a result.

The simplicity of this resource lent itself well to the product being adaptable to individual learner needs\(^{20}\), various time constraints, and different learning contexts. Nonetheless, despite the lack of rigidity and rules, TF1 was concerned that C4 might prove too challenging for learners, and that it would only be suitable for learners from Grade 3 upwards. TF2-2, however, recognised that learners throughout the FP would benefit from using the product – where Grade R learners would use the product to develop their manipulative or fine motor skills, and the older learners would benefit from the literacy aspects.

\(^{20}\) EF1 was the only participant to suggest that any of the products be designed to address a particular learning level. However – through further discussion – the researcher was able to deduce that EF1 was not suggesting that the product should focus on one level in isolation, but that she was suggesting that C4 be available in different ‘versions’ to address all learning levels (in other words, different block sets should depict words and pictures that are level-specific). On the contrary, EF4 was apprehensive of the suggestion to have different sets to target various levels, as this posed challenges with regard to cost implications as well as product management.
4.8.2.5 Making an Informed Decision

Although the data analysis (4.8.1) concluded that C4 was deemed the concept that ought to be developed further, it must be noted that when the data from Graph 16 is represented as a percentage (see Graph 17), the difference between the percentage of weighted responses received by the first choice (C4 at 31%) and the second choices (C1 and C3 at 26% each) is not vast. This indicates that participants tended to respond well to all three of the top choices, and that there is a need to address language learning in different capacities. This also likely means that if C4 were further developed, it would definitely be received very positively by the participants (especially as 12 of the 13 respondents approved of the product), but that if C1 were developed further instead, it would likely also be well received\(^\text{21}\). The researcher is, however, hesitant to draw the same conclusion for C3, due to the dichotomy of opinions that were expressed regarding this concept.

It is worthwhile commenting on the breakdown of participants’ first preferences, according to sample group categories. These have been indicated in Graph 18, and the samples groups are as follows: key informants (E), expert facilitators from The Link (EF), volunteer facilitators from The Link (VF), and teachers from the various schools (TF). Coincidentally, both key informants selected C4 as their first preference and C1 as their second preference\(^\text{22}\). The EFs’ first preference was split evenly between C1 and C4; all three VFs chose C3 as their first preference; and the TFs’ first preference was split between C1, C3 and C4. The VFs’ clear preference for C3 alerted the researcher to the phenomenon that participants who assume ‘managerial’ positions (EFs and TF2-1) preferred C1 and C4, and that participants who fulfil ‘operational’ roles (VFs and remaining TFs, with one exception)

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\(^{21}\) Although not formally captured, a few participants had struggled with ranking the concepts in order of preference, explaining that all four concepts would be beneficial, depending on the type of learner and the specific context.

\(^{22}\) Since no other sample groups showed consistency in their second preferences, this has not been indicated on a graph.
had a clear preference for C3\textsuperscript{22}. The researcher speculated that this might be because ‘operational’ participants focused predominantly on the experience of learning, and how to maximise the enjoyment of the learning activity (in which they would also partake); whereas ‘managerial’ participants showed greater consideration for the cost and logistics of managing the products. The researcher further ventured that the ‘managerial’ participants gravitated towards C1 and C4 due to storage concerns (both C1 and C4 were presented with tidy storage solutions), durability and longevity of the products (concerns had been raised that C3 might get damaged, or that components may get lost), administrative concerns of initiating the game-play (C3 would require more complex explanations and set-ups), and the ability to maintain control of the learning environment.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{graph18.png}
\caption{Graph 18: Stacked bar graph indicating first preferences of concepts according to participant sample groups. (Graph by author 2017)}
\end{figure}

The identification of this data trend is important because it reiterated the researcher’s previous statement of focusing on the development of either C1 or C4, but not C3. From the researcher’s perspective as a designer, this decision was driven by considerations for marketing and purchasing of the end product. More specifically, the end product needs to appeal predominantly to participants in ‘managerial’ positions, since they are responsible for making – or influencing\textsuperscript{24} – the decision of what resources to purchase for their respective institutions (this especially holds true for EF4 and TF2-1\textsuperscript{25}). Furthermore, E2 is also in the position to make such purchasing decisions, and E3 (as a

\textsuperscript{22}It was also interesting to note that the one-on-one ‘operational’ facilitators (VFs) and group ‘operational’ facilitators (TFs) responded so similarly to C3, when their feedback during the first round of field research (see 4.5) differed specifically on the basis of design considerations to support one-on-one and group learning contexts respectively.

\textsuperscript{24}It must be noted that in the cases of EF1, EF2, and EF3, the participants filled both managerial and operational roles. The reflections in this section have, however, been based on the assumption that these participants provided feedback within their capacity as centre managers, instead of volunteers. This is exemplified by EF1’s commentary that although C3 would be fun to play, it was not conducive to The Link’s purposes, due to time and space constraints, and the specificity of their learners’ literacy capabilities.

\textsuperscript{25}TF2-1 astutely noted that even though she would not purchase C3 for her school, it was likely that the product would appeal immensely to parents.
retailer of educational resources) has the expertise to determine the types of resources that would most likely be purchased by her customers. This being said, the researcher also heeded an earlier remark by E3, who commented that teachers (or 'operational' facilitators) need to find the product enjoyable, because if the facilitators themselves experience no enjoyment from the product, they would not be encouraged to use it.

It is evident that the researcher was faced the difficult task of developing a product that would appeal to the 'managerial' participants – in order to ensure the purchasing of the product – but that would simultaneously appeal to the 'operational' participants – in order to ensure that the product is actually used in the various learning environments. To aid with this task, the researcher referred to the previous data analysis. With reference to the radar graph in Graph 13 in particular, it is evident that the enjoyability and engagement, and the variety and adaptability categories were what appealed most to participants with regard to C3. When it came to developing either C1 or C4 further, the researcher realised that it was advisable to improve either concept in terms of these categories, especially with regard to the incorporation of a competitive game-play element. The greatest challenge that this would present, is that although some participants thought the competitive element would manage to maintain learners’ attention, others thought it might “scatter [their] concentration” (EF3). The excitement factor also needed to be carefully balanced with the manageability of the game-play, otherwise the product would no longer appeal to the ‘managerial’ facilitators.

Another notable limitation that would be faced regarding the development of either C1 or C4, is the inability to facilitate learning in big groups. This being said, since both concepts are at least able to accommodate small groups, fewer products would be needed to support an entire class, in comparison to a product that could only support a single learner at a time. Additional suggestions for improvement – that could be applied to any of the concepts – included: incorporating activities that would support writing; providing multiple game-play options to better target holistic development of learners; considerations for product cost; increasing the visual appeal of the various components; careful consideration for storage, and how to best manage the product in a typical learning environment; not relying on too much input from the volunteers; and ensuring the product ‘grows’ with the learner – throughout the year, and throughout their FP education.

Although the various concepts have been analysed according to the ratings scales developed from the feedback forms, and the ranking of preferences, the concepts have not been weighed up according to the design requirements that the participants themselves identified as being most

26 Subsequently, it appeared that the 'operational' facilitators based their product preferences on what their learners would find most enjoyable, not necessarily what they themselves would find most enjoyable (although it is likely that these would overlap in the case of C3).
important. As was indicated in Graph 5, the most important design considerations should be: play-based learning, ease of use for learners, enjoyability, ease of use for facilitators, evidencing educational value, being conducive to both individual and group use, durability, multisensory stimulation, understandability, and complementing the curriculum. Although these were ascertained in order to evaluate the end product, the researcher’s reflections on how these requirements pertain to both C1 and C4 have been indicated in the rating scales depicted in Figure 46. These rating scales indicate C1 on the left-hand side and C4 on the right-hand side. The blue arrows indicate if the respective requirement is equally balanced between the two concepts (neutral), or if it leans towards either concept.

![Figure 46: Rating scales representing the researcher's reflections on how the highest priority design requirements pertain to Concept 1 and Concept 4. (Rating scales by author 2017)](image)

Although the rating scales in Figure 46 show that the researcher does not believe that C1 and C4 weigh up equally in all fields (particularly with regard to ease of use for facilitators, evidencing educational value, understandability, and complementing the curriculum), on average, neither concept showcases a particular advantage over the other. Ultimately, the researcher made the decision to pursue Concept 4 in the design development phase. Although C1 had the upper hand in terms of multisensory stimulation, enjoyability and being easier to manage and pack away, C4’s evident educational value, the risk of C1 being too intimidating or advanced for the early FP years, and the reliance of facilitators to direct the game-play in C1, encouraged the researcher to pursue C4, as originally propagated by the data that was depicted in Graph 16.
4.8.3 DESIGN DEVELOPMENT

Once the data analysis and subsequent reflection resulted in the decision to pursue Concept 4, the development of the product ensued. Starting with Concept 4 as it was presented in 4.7.3.4, the researcher developed this idea into a fully realised product solution, that was – once again – presented to the study participants. The development of the proposed intervention spans three interdependent considerations: the physical product and the storage thereof; the content depicted on the product components; and the game-play of the product in both group and one-on-one learning contexts. The development of the product with respect to these three considerations has been discussed accordingly. Full sized renderings can be found in Appendix K.

4.8.3.1 PHYSICAL PRODUCT DEVELOPMENT

The physical components that constituted C4, as depicted in Figure 44, consisted of a set of rectangular wooden blocks in a variety of lengths that fit precisely into a simple five-sided box with a slide-lid. Although the opportunity for form development of the wooden blocks was limited, the physical product development of C4 was also considered in terms of ergonomics and tactile sensibility, materials and manufacturing processes, and a more suitable storage solution. As can be seen in the descriptions below, a number of these considerations were directly driven by the prioritisation of product safety.

Form Development

As mentioned before, the opportunity for form development of the various building blocks was limited in principle, as a six-faced rectangular extrusion does not present great potential for further exploration. However, there were still a number of factors that needed to be considered. The size and the proportions of the various blocks was the first notable aspect, especially as some of the participants had specifically mentioned that the blocks should be increased in size (E3, TF1). Larger blocks would be easier to manipulate (especially for younger learners), but this did pose the problem of taking up more physical space in terms of product storage. Larger blocks also result in larger surface areas and the depicted text and images could be increased accordingly. In addition to increasing the size of the blocks, a square block with a proportion of 1:1:1 was added to the set. The reason for this becomes evident in the sections discussing the content (4.8.3.2) and game-play development (4.8.3.3). A rendering of the five proposed block proportions can be seen in Figure 47.
The final size of the various blocks was determined through consideration for anthropometrics and product safety. According to *The Measure of Man and Woman*, between the ages of six and nine, children’s hand lengths increase from 126mm to 143mm, and children’s hand widths increases from 59mm to 65mm (Tilley 1993:4-6). As mentioned before, learners’ fine motor control, accuracy of manipulation, and strength all increase as they get older. Bearing these two factors in mind, the researcher believed that the intended learners would be able to manipulate blocks that are based on the extrusion of a 25mm x 25mm profile. Furthermore, 25mm is a standard size that is used for dice that need to be readable from a distance, and is thus often used for classroom, casino, or decorative purposes (Dice Game Depot [sa]).

With regard to product safety, Tilley (1993:62) refers to a small parts gauge from the *Code of Federal Regulations* (by USCPSC), which indicates that no component must be small enough to fit entirely into the cylinder illustrated in Figure 48. Even though the smallest component of the developed product would hypothetically penetrate the shallowest depth of 25.4 mm, the 25 mm x 25 mm square profile (with a fillet of 2 mm) would not fit within the 31.7 mm diameter tube. This means that even though the product is intended for use by FP learners, it would not pose a safety risk if it were unintentionally used by children under the age of three years.

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27 It must be noted that even though some participants had suggested that the blocks be increased in size, the USCPSC’s *Age Determination Guidelines* (Smith 2002:52,66) for toys warns that from the age of six, children are more inclined to playing with smaller blocks that present with more complexity. This being said, Smith (2002:63) does refer to “very small pieces” as being less than 25 mm (1 inch) and large pieces as being between 50 mm and 75 mm (2–3 inches).

28 This was a noticeable increase from the original blocks, which measured 21 mm x 21 mm.
The form development was also directly related to the ergonomics of the product. The hand sizes and motor skills of FP learners would be suited to the size range of blocks suggested by the researcher. These could, however, still be easily handled by the facilitators. In order to improve the comfort of using the components, the researcher filleted the corners of the blocks. With fillets of 2mm the blocks were comfortable to interact with, but the fillets did not encroach too much on the surfaces to restrict the sizes of the text and images. These fillets also did not hamper the opportunity for construction play.

The researcher explored the option of applying a texture to the surface of the blocks, in order to further increase the tactile stimulation, however this option was not taken into further development, as the researcher deemed it an unnecessary feature that would complicate the manufacturing process, and would interfere with the graphical elements that would be applied to the surfaces. Furthermore, surface textures could also be a potential dirt or germ trap. The blocks have, however, been specified to have a matte surface finish. The matte finish is visually softer looking, and provides a smooth, pleasant surface with which to interact.

Materials and Manufacturing Processes
As indicated in Graph 6, wood was participants’ most preferred material from which to manufacture an educational toy. C4 was particularly conducive to be manufactured from wood, and the individual components as well as the storage solution were indicated as such in the concept descriptions and rendering in Figure 44. Wood exhibits a number of benefits that render it particularly suitable to C4,
but most notably, wood presents as an unusual material for learners who are from low income backgrounds, and who tend to be exposed to learning resources that are predominantly made from paper-derivatives or plastic. Incidental comments from participants during the feedback form completion sessions also evidenced great nostalgic affinity to the notion of wooden blocks, which reflects the suggestion to incorporate elements from the participants’ own backgrounds. Although wood is typically considered an environmentally sustainable material, this characteristic is also what puts it at risk of rotting if not properly treated, and wooden products run the risk of splitting or splintering, thereby “leaving children at risk from injury” (Clark 2015).

Wood also poses some other drawbacks; the greatest of which is that wood does not allow for easy application of graphic elements, especially not in a mass-production capacity. In terms of product safety, Tilley (1993:62) recommends that “[t]oys should have integral colours rather than a paint or other coating that can peel or flake off”. Although laser engraving images and text was a suitable solution for including ‘integral’ surface applications, the researcher was urged to include bright colours on the blocks, and to refrain from relying on line drawings, both of which steered the researcher away from laser engraving. As it is labour-intensive, the manufacture of wooden blocks is also more suitable for batch production, and the end product would likely not be affordable to the intended target market. By nature, wood is also an inconsistent material, which means that it poses some difficulties with regard to manufacture and standardisation.

Plastic, on the other hand, should not be disregarded as a worthwhile alternative to wood. Stringent safety requirements for toys, as well as parental insistence, means that plastic toys should not be assumed to be a low-end products (Clark 2015; Plastics The Mag 2011). Plastic might inherently be a ‘colder’ and ‘less friendly’ material than wood, but it does come with the benefit of being more durable and it poses fewer safety risks, since the raw material can be easily controlled, toxicity can be completely avoided, and – if damaged – it does not pose the risk of exposing splinters. Plastic products can also be washed more readily than wooden products, which is an important consideration as younger learners may be prone to putting components in their mouths or dropping them on the floor. In order to limit the health risks posed by germs and dirt, the components have been designed to be easy to clean (Clark 2015). Plastic especially outperforms wood when it comes to appealing to the aesthetic preferences of children, and product affordability. Plastic can easily be dyed and allows greater opportunity for applying graphic elements onto surfaces. The application of decals would be suitable for small-scale manufacture or prototyping, and the proposed blocks would lend themselves well to flexographic or pad printing on a mass-production scale. Although the manufacture of plastic components may involve significant set-up costs (in terms of moulds), plastic blocks would be far more affordable than wooden blocks if produced and distributed en masse.
Although wood was the participants’ material of choice, the cost thereof would be an inhibiting factor for the target group of the proposed product, and the cost-to-benefit ratio of plastic urged the researcher to opt for this instead. The proposed material is polymethyl methacrylate (PMMA). This plastic poses the benefits of having good impact strength, being easily coloured, and being heat stable (Romanowski [sa]). Plastic manufacturing processes also allow for the improved control of other variables through use of fillers\(^{29}\), for instance, to protect the components from UV, to increase flexibility or to reinforce the raw material (Romanowski [sa]). Essentially, this means that the physical traits and longevity of the product can be engineered. In the case that the blocks are used for unintended purposes, or suffer accidental use (for example being stood upon, or dropped) the various components need to endure greater impacts than would be elicited through their intended use. To ensure product safety, measures need to be taken to minimise plastic’s tendency towards brittleness, as excessive force may result in components snapping or chipping, which may cause sharp or jagged edges that would pose a safety risk (Clark 2012).

The environmental impact of plastic products is inevitably questioned; however, sustainability need not be restricted to products that make use of ‘environmentally friendly’ materials. Although the manufacturing processes and the raw materials of plastic products are considered harmful to the environment (due to their high ‘energy footprint’ and not being biodegradable if discarded irresponsibly), the longevity of plastic products can be advantageous. If the proposed product is successful at supporting learners throughout each year of the FP, and can be used year upon year without needing to be replaced, and without being discarded due to breakage or redundancy, the use of plastic would be beneficial in the long term. Furthermore, if the durability and longevity of the product is evident to the target market, they are more likely to pay a slightly higher price for the product.

**Storage Solution**

A notable concern that was raised with C4 was that the storage could be potentially problematic (EF1). This was an even greater concern once the researcher had made the decision to increase the individual block sizes. In order to reduce the amount of space occupied by the product, it is logical to stack the blocks neatly into a box, as was originally proposed, as opposed to jumbling the blocks together in a bag or container. This original suggestion did, however, present a number of potential problems. Firstly, participants raised concerns that it would be too complex to stack the blocks in the correct configuration; secondly, participants were concerned that it would be too time consuming to arrange the individual components into the box; and thirdly, while presenting the block models to the participants, the researcher realised that it was, in fact, rather difficult to remove the blocks from the box due to the tight tolerances.

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\(^{29}\) Although no phthalates may be added to children’s products, as these pose safety risks (Clark 2015:[sa]).
Although a number of possibilities were investigated, the researcher settled on an idea that still allowed for neat packing, but that was easier to manage and access. The final storage tray can be seen in Figure 49. Instead of all blocks being stacked together, the proposed storage system only requires a single ‘layer’ of blocks to be stacked and stored together. Each layer is stored in a separate tray, that closes with a snap-fit lid, and each tray is colour-coded based on the content that is depicted on blocks stored within (see Figure 51). This allows facilitators to select specific modules based on what they are aiming to teach on the day, without needing to open each tray to check the contents. Additionally, each tray is fitted with a false bottom, below which instructions and additional information can be stored (see Figure 50).

![Figure 49: Rendering of proposed storage solution, showing a single tray as it is being opened.](Design and rendering by author 2017)

![Figure 50: Rendering of proposed storage solution, showing a section view and an exploded view to demonstrate the false bottom below which an instruction booklet is stored.](Design and rendering by author 2017)
The proposed set would consist of six trays (further explained in 4.8.3.2). The trays have been designed in such a way that they can all slide into one another for ease of transport and storage. Alternatively, the trays can be cross-stacked on top of one another for easy access. Both options have been depicted in Figure 51.

![Figure 51: Rendering of proposed storage solution, showing four trays that have been slid into one another on the left-hand side, and two trays that have been cross stacked on the right-hand side. (Design and rendering by author 2017)](image)

This storage system is more complex and bulkier than the one originally suggested in C4, but it is still easily manageable and relatively space efficient. Most importantly, this is a modular system, which would allow for additional trays to be added if needed, or multiple sets could be combined. An added benefit of this system is that accommodating single layers of blocks means that the set is compartmentalised, which is more likely to encourage facilitators to use it, as it is far easier to manage and more supportive of incremental learning. Manufacturing the storage system from plastic carries the same advantages as described previously with regard to the manufacture of the blocks. The trays would however be made from acrylonitrile butadiene styrene (ABS), as this thermoplastic is better suited to the design and use of the trays. Most notably, this plastic is suitable for complex moulding and a wide range of colouring, is lightweight, and allows for greater elasticity which is necessary to enable the working of the snap-fit closure.

4.8.3.2 CONTENT DEVELOPMENT

The content that had been proposed for Concept 4 was a combination of images and words, where the elongated faces of each block were to depict a contextually relevant image or icon on one end, and a word on the other end. Although this was used as a starting point, the content was reconsidered and presented on the components quite differently to what was originally suggested. The content development was directly linked to the educational value of the product; this is what would appeal most to the participants, but is also that with which the researcher has the least
experience. As such, the content development was the most time-consuming aspect of this design iteration. The content development has been discussed in terms of the educational content, the visual appearance of the content, and how this was developed into a full set.

**Educational Content**

It was previously mentioned that the new proposed set of blocks included a dice-shaped block, and that this decision was driven by the development of the educational content. The reasoning was twofold: firstly, the researcher wanted to carry through an aspect of Concept 1, due to the enthusiastic response elicited by the product; and secondly, the researcher was concerned that the originally proposed word-and-image content combination would be too limiting in terms of gameplay. As such, the researcher decided to split the words and the images onto separate blocks, and carried the idea of a six-sided dice (or ‘image-block’) through from C1. Initially, the researcher had intended to depict words of varying lengths on the remaining blocks, however considerations for gameplay lead to the decision to depict letters and sounds on the longer blocks instead. In so doing, the product focuses on the teaching of the most fundamental skills (or the ‘building blocks’) of language; all words are made up of sounds, and the decoding, encoding, and manipulation of these sounds are what drive language – and ultimately, literacy – learning. Each block-length depicts very specific content, with the content generally becoming more advanced as the block lengths increase (apart from the second-shortest block). As can be seen in Figure 52, the blocks depict vowels, digraphs, consonants, two-letter consonant blends, and three or four-letter blends.

![Figure 52: Rendering of final proposed blocks depicting various letters and sounds. (Rendering and design by author 2017)](image)

It must be noted that the researcher did not consult with any experts to assist with the content development, and that these decisions were driven by what the researcher had learnt throughout the research process.
The image-blocks, that were mentioned before, depict images or icons that the researcher believes are relevant to the SA context (examples of which can be seen in Figure 53). The selection of images depicted on each block has been specifically selected based on the characteristics of the word. For example, one block would only depict CVC words containing “-a-” (cat, hat, sad, bag, car, bad) or only depict words that end in digraphs (fish, tick, sock, lock, ball, comb).

![Figure 53: Rendering of final proposed blocks depicting examples of the icons that the researcher believes is relevant to the SA context. (Rendering and design by author 2017)](image)

In order to develop the content that would be displayed on the various blocks, the researcher consulted a number of different sources. The vowel-blocks were straightforward, with each face representing a vowel (a, e, i, o, u) and alternating the vowel that was repeated on the remaining face. The consonant-blocks were determined by looking at the frequency at which letters occur in the English language, specifically looking at the most common first and last letters. Although all 21 consonants feature on the blocks, the number of times that they are repeated was determined by the frequency at which the letters occur in English. The most common digraphs and blends were determined by looking at the sounds most frequently used by DIY reading resources for children, as well as the sounds that are listed in the CAPS documentation for the English Home Language and First Additional Language subjects.

The selection of images was more challenging. The researcher consulted the following lists of words: the sight word resources used by The Link; the words that are used most frequently in the English language in general; both the Dolch and Fry sight words lists; the CAPS list of high frequency words; and finally, Ogden’s list of picturable words. Using these lists as a guide, and focusing on the words that appeared most frequently among the lists, the researcher distilled these to 150 picturable words that could be grouped into common themes (for example my body, my home, colours, etc.), and that
the researcher believed were relevant to the SA context. Hereafter, the researcher grouped these words into sets of six that shared a common linguistic characteristic (for example, CVC-words, words ending in digraphs, words containing two digraphs etc.) and that could represent incremental levels of difficulty.

Once the words themselves had been identified, the researcher identified additional interpretations of the potential images (for instance, a smiling face could represent ‘smile’, ‘happy’, ‘joy’, ‘laugh’ etc.), whereafter the original set of words, and the additional potential interpretations were broken down phonologically (according to sounds, for example ‘cow’ is broken down into ‘c-ow’, or ‘boat’ is broken down as ‘b-oa-t’). The resultant letters, digraphs, trigraphs and blends were compared to the original set of letters and sounds, and were amended accordingly to reflect the frequency at which they appeared in the picturable words.

**Appearance**

The aesthetics of the blocks was predominantly driven by consideration for what would appeal to learners. The colour of the blocks themselves is a warm-toned off-white, which was chosen for practical reasons. The first reason is that the intended images would look best and most appealing if printed on a light, neutral background. Although a pure white might be a more obvious choice, the off-white is a visually warmer colour, which subconsciously makes the product appear warmer and ‘friendlier’ to the touch. Additionally, a pure white surface is more prone to showing dirt and scratches on the surface, whereas the off-white colour would be more forgiving in this regard. Similarly, the matte finish of the blocks is softer to the touch, and is more forgiving than a glossy finish, which shows up scratches and surface imperfections more easily, and is also prone to attracting fingerprints.

All sounds and letters were presented in black writing, that was as large as could be accommodated on the blocks (this did result in the three-letter sounds being printed in a slightly smaller font than the single letters). The contrast and size of the written content optimised the legibility for learners and facilitators alike, especially for classroom use, where blocks are likely to be viewed from a distance. The font that was chosen is called *Print Clearly Bold* and is available online for free use[^1]. All sounds and letters were written in lower case, as this is what young learners are introduced to first, and all sounds and letters were underlined in order to visually guide learners’ eyes as they build words. As is common practise with language-based games and toys, the underlining also acted as an indicator as to the correct orientation of the blocks, since letters such as ‘d’ and ‘p’ can be easily confused. It must be noted that the researcher did anticipate some problems with the font, since the letters ‘q’, ‘t’

[^1]: [www.fontspace.com/blue-vinyl/print-clearly](http://www.fontspace.com/blue-vinyl/print-clearly)
and 'y' do not follow common SA configuration (see Figure 54). The font was, however, deemed suitable for this phase of the design process.

Figure 54: The letters 't' and 'y' in the *Print Clearly Bold* font as they would be represented on the blocks, which the researcher identified as being potentially problematic.  
(Graphic by author 2017)

Once the researcher had finalised the list of picturable words, representative images were sourced from web based resources. Keeping the aesthetic of the images within a specific style was quite difficult, due to needing 150 unique images. The images also needed to conform to the suggestions of participants; therefore, the images could not be line drawings, and they had to be brightly coloured. In addition to this, design specifications guidelines (2.4.2) suggest that the colour scheme that is depicted on the product should balance masculine and feminine influences in order for all children to relate to the design (Hanna 2008:777; Smith 2002:272). Smith (2002:20) also indicated that as learners approach the end of the FP, their interest shifts from cartoon characters to real life characters and personalities. In order to balance these requirements and requests, the researcher turned to colourful vector-based icons. Although these were not necessarily designed by the same author, they do nonetheless conform to a similar visual style as can be seen in Figure 53 (all images have been listed and referenced accordingly in Appendix K). As shown in Figure 55, the icons and the chosen font work well together to present a visually clean, yet ‘friendly’ and appealing aesthetic. The researcher believes that these icons are a reasonable compromise in terms of visual styling; although they are certainly not akin to real-life characters, they are more sophisticated than cartoon characters that are typically used to appeal to young children. As mentioned before, the concept of choosing a 'middle ground' in any design decisions may result in appealing to all learners, or may very well appeal to none of them. This uncertainty evidences the importance of testing the product with the learners themselves.

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32 Furthermore, feedback from the previous interviews clearly showed that none of the participants thought that any of the concepts would benefit from gender designations.
Since the blocks could not be brightly coloured due to the printing limitations, the storage trays were made so in their stead. As shown in Figure 51, the six proposed trays are all different colours, according to the difficulty of their contents (further discussed below). Although the blocks themselves may not be very brightly coloured, it is important to remember that what learners would see if the product were displayed in store, or when the facilitator presents the product to the learners, would be the set of trays (or an individual tray). As such, the onus falls upon the design of the storage system to appeal to learners, and that this needs to capture learners’ attention and entice them to want to engage with the product.

**Design of the Set**

Through a combination of predetermined block sizes, the subsequent size of the storage tray, and the data indicating the frequency of occurrence of various letters and sounds, a full set of blocks was deemed to consist of the following:

- 25 x image-blocks (ratio 1:1:1)
- 14 x vowel-blocks (ratio 1:1:1)
- 12 x consonant-blocks (ratio 1:1:3)
- 12 x digraph-blocks (ratio 1:1:2)
- 6 x two-letter consonant blend-blocks (ratio 1:1:4)
- 5 x three-letter blend-blocks (ratio 1:1:5)
- 2 x ‘wild card’ blocks (ratio 1:1:1)

This would result in a set of 74 blocks of a variety of lengths, that can easily be arranged into six single-layer square grids, according to the difficulty posed by each block (see Figure 56). As mentioned before, each square grid can be stored in a separate tray, that would be colour-coded.
according to the difficulty of the blocks within. Although this proposed set could be marketed and sold as a ‘classroom set’, the modularity of the storage system allows for the purchasing of individual trays only (for instance, with suitable facilitation the set of image-blocks can be used to facilitate the learning of any language, not only English) or additional trays (such as sight words) to expand the existing set. Furthermore, the block-sets could be adapted to include fewer trays and blocks in order to be more suitable for home use.

![Figure 56: Rendering depicting the six single-layer square grids into which the 74 blocks of the proposed set can be arranged. The stack of blocks on the right-hand side acts as an indicator for the volume that the blocks would occupy.](image)

(Design and rendering by author 2017)

Some participants had responded to C4 with concern that too many blocks would be required to accommodate all reading levels, and that the resource may confuse weaker learners, and subsequently suggested that the number of blocks used for individual learners or specific levels should be limited. Although these concerns were valid, they contradicted the USCPSC’s guidelines for toys, which suggest that – in order to appeal to younger learners – block-sets should contain a variety of shapes and sizes, and consist of between 80 and 100 components, whereas older learners are more likely to be interested in building more complex and elaborate structures, with sets containing over 100 components (Smith 2002:52). The DP is far simpler than what Smith (2002:52) suggests, but more advanced than what some of the participants requested. However, the storage system, and the single-layer block organisation, does allow participants to only use a limited number of level-specific blocks as they deem fit for their learners. This contradictory information once again shows the importance of testing the product with the learners themselves.
4.8.3.3 GAME-PLAY DEVELOPMENT

Although some of the concepts presented in the previous design phase had a particular set of rules or intended game-play, the DP is intended to be an open-ended support resource as opposed to a ‘toy’. This allows both learners and facilitators greater freedom of imagination and creativity when it comes to product use. This being said, the product would still be accompanied with a set of guidelines for suggested use, for both group and one-on-one learning contexts. This speaks to participant concerns that the resource should not rely too heavily on the input of facilitators (especially volunteer facilitators at The Link centres), and to Smith’s (2002:67) indications that open-ended resources are more appropriate for younger learners, and that older learners prefer intentional resources that come with specific goals and instructions.

The simplicity of C4 lent itself well to being very adaptable, and the DP aimed to carry this through by being adaptable to learner levels, one-on-one and group contexts, and both long and short time slots. Being adaptable to various learner levels means that the product would be able to ‘grow’ with the learners, throughout each year of the FP and as learners progressed through the curriculum. Being conducive to use in shorter, one-on-one time slots, as well as longer, group-oriented time slots means the product would be suitable for use in supportive teaching environments (such as The Link’s sessions) as well as general classroom teaching. Maintaining a balance between one-on-one and group learning contexts is very important. Whereas the one-on-one learning allows for individualised remedial support, the group learning allows opportunities for both competition and cooperation which develops social skills and provides learners with the opportunity to teach one another.

Some of the suggested guidelines have been described below, but there are a few important factors that should first be noted. Firstly, the resource allows predominantly for the placement of blocks such that the words can be read horizontally. Allowing for the random orientation of letters is bound to confuse elementary readers, however allowances can be made to incorporate blocks in a vertical orientation for more advanced learners. Secondly, each image can have multiple interpretations (for example, a smiling face could represent ‘smile’, ‘happy’, ‘joy’, ‘laugh’ etc.). Multiple interpretations are encouraged, but a list of intended interpretations would be provided. Thirdly, the image-blocks and letter-blocks need not be used simultaneously. The letter-blocks can be used to build any words, not just those represented on the image-blocks. Furthermore, the blocks that depict images can be used to support language development, not necessarily literacy development (reading). Although literacy is an important component of language development, the images can still support language learning without incorporating literacy activities (for instance, practicing vocabulary, telling a story, or comprehension exercises).
**One-on-One Use: Suggestion 1**

The facilitator chooses one image-block, and a tray of letters or sounds that correspond with the level of difficulty of the block. The learner has to build the six words that are represented on the block (see Figure 57). As learners progress, either a more difficult image-block can be selected, or multiple blocks can be selected.

![Image](image.png)

*Figure 57: Rendering depicting an example of Suggestion 1 for one-on-one game-play. (Design and rendering by author 2017)*

**One-on-One Use: Suggestion 2**

The learner is provided with the number and size of blocks the facilitator deems suitable. The facilitator provides the learner with a suitable starting block, whereafter the learner uses the remaining blocks to build a ‘word-snake’ (see Figure 58). More than one learner can be involved in this activity (a suggested maximum of 3). Either multiple learners build their own ‘word-snakes’, or they can work together to build one ‘word-snake’. When used in a one-on-one context this activity can be timed to add a competitive element, or learners can compete to complete their ‘word-snakes’ first.

![Image](image.png)

*Figure 58: Rendering depicting an example of Suggestion 2 for one-on-one game-play. (Design and rendering by author 2017)*
**One-on-One Use: Suggestion 3**
The facilitator chooses a suitable number of image-blocks. The learner rolls each block like a dice, and is required to identify the image (see Figure 59). Depending on the level of the learner, they might only be required to correctly identify the image, write down the corresponding word, or use it in a sentence. Multiple blocks can be used as prompts to construct more complex sentences, or build stories. This can be used simply to build vocabulary, or can be combined with literacy or comprehension exercises.

![Figure 59: Rendering depicting an example of Suggestion 3 for one-on-one game-play. (Design and rendering by author 2017)](image)

**Group Use: Suggestion 1**
Each learner is handed an image-block. The learner is required to write down the words represented on their image-block. Alternatively, the images can be used as prompts for sentence construction, or story-building. This would also be suitable for use in small groups, especially in cases where the more advanced images are too challenging for the learners. In this case, small groups of learners need to share an image-block. Subsequent literacy activities can be completed either individually or in groups.

**Group Use: Suggestion 2**
Prior to the lesson, the facilitator uses the image-blocks to construct a basic story to tell instead of reading from a book. Prior to ‘story-time’, each learner is handed an image-block. As the facilitator tells the story, she emphasizes the words that correspond to the image-blocks, and the learner with the matching block needs to respond and spell out the word. Alternatively, the facilitator can construct a ‘fill-in-the-blank’ story. Learners take turns to ‘fill in’ the omitted words by providing the words that are represented on their image-blocks. This would likely result in a nonsensical, fun story.
**Group Use: Suggestion 3**

Groups of younger learners can be provided with the entire set of blocks, and can use these simply for construction play. Supervising facilitators can use the image-blocks as prompts for vocabulary development. Young learners can start becoming familiar with written letters.

### 4.8.4 USER TESTING AND FEEDBACK

Once the DP had been finalised, the researcher approached the participants for feedback. As mentioned before, Boulton (2009:44) is adamant that a good design process involves frequent testing or feedback opportunities. Participants were first required to complete an online feedback form (see Appendix I), whereafter they were asked to interact with the prototype samples, as shown in Figure 60. These prototypes were manufactured by the researcher. The individual blocks were cast from resin and spray-painted, whereafter individual decals were applied. This feedback indicated another phase of divergent research, as the researcher was faced with a number of different opinions and suggestions. In order to design a product that is intended for, and appeals to, children, the children need to be kept in mind at all times, and product testing is essential (Torres 2008:496). As such, some of the participants were asked to test the product on individual learners and learner groups. This research further advanced the ideographic normative approach described by Routio (2007 ‘How to create theory of design’), as the researcher neared the final design iteration. The research that was conducted during this phase is reported in Section 3.5.4.3.

![Figure 60: A selection of prototype samples of the developed product. The participants were presented with an almost complete ‘classroom set’, with only five image-blocks missing from the proposed set. (Photograph and prototypes by author 2017)]
Phase 8 encompassed the third design iteration, and indicated the third ‘action’ cycle. As with the previous phase, Phase 8 commenced by collating and analysing the user feedback that was gathered during the last step of Phase 7. These user responses to the DP were used by the researcher to identify elements that could be amended to improve the usability and functionality of the DP. The researcher’s reflection, together with the design refinement, once again indicated a convergent phase of the research. By learning from user feedback and doing heuristic evaluations, the researcher makes suggestions for design refinement. This phase concluded the design and development stage, and was followed by the third and final stage of the design process.

4.9.1 DATA ANALYSIS

In order to guide the final design iteration, Phase 8 commenced with the analysis of the data that was gathered from user feedback on the DP and interaction with, and testing of, the prototype samples. Through the analysis of this data, the researcher was able to identify the strengths and weaknesses of the DP (as evaluated by the secondary users), and by once again quantifying participant opinions (through rating scales) the researcher was able to ascertain a detailed evaluation of the DP. The data has been discussed in accordance with the various feedback sections: participants’ general response, product assessment, user interaction with the product, and user testing of the product. The data in this section references the participant feedback forms and transcripts of all researcher notes from the development and product testing phase, that can be found in Appendix J.

4.9.1.1 GENERAL RESPONSE TO PRODUCT

As can be seen in the feedback form in Appendix I, participants were required to rate their feelings towards the DP at various points throughout the preliminary product descriptions. Participants were required to rate their attitude in response to: the product and content, the storage solution, one-on-one product use suggestions, and group use suggestions. The resultant data for the general participant attitude is shown in Graph 19.

33 It must be noted that – as before – all column graphs that represent percentages have a minimum bound of 50% and a maximum bound of 100%. These have been clearly indicated on the relevant axes. Any exceptions to this format have been mentioned accordingly.
34 Where 1 represented ‘very negative’, 2 represented ‘negative’, 3 represented ‘neutral’, 4 represented ‘positive’, and 5 represented ‘very positive’
The graph shows that participant attitudes were generally between ‘positive’ (4 out of 5, or 80%) and ‘very positive’ (5 out of 5, or 100%) for all aspects of the DP, and when responses were aggregated the product received a rating of 4.5 out of 5 (90%). Participant attitudes did, however, decline slightly (0.8%) between the description of the product and content, and the description of the storage system. Subsequently, attitudes increased significantly (5.4%) in response to the one-on-one product use suggestions (which received the highest response overall with 93.1%), but fell again (by 3.9%) in response to group use suggestions.

Although some participants simply rated their responses as ‘positive’ or ‘very positive’ across all aspects of the DP (E2, E3, EF3, VF2, VF3, TF2-1, TF2-2, TF3), it is interesting to note shifts in attitude as participants progressed throughout the descriptions. For instance, EF1 and VF1 both had increasingly positive responses once they were more familiar with how the product would be used; EF4 and TF1 had a decreased response to the group use suggestions; and EF2 had a noticeable dip in her attitude upon responding to the storage system. Since participants had been asked to elaborate on their responses throughout the product description section, the researcher had the opportunity to gain deeper insight to some of the participants’ shifts in attitude. EF1’s elaboration on rating the product and content 3 out of 5 was that she had “[no] thoughts yet” and needed to know more before accurately responding to the product, and VF1’s elaborations on the product and storage system descriptions included a number of suggested amendments, whereas her responses to the product use suggestions indicated approval for the product’s adaptability. Similarly, EF2’s elaboration on the storage system, and EF4’s elaboration on the group use suggestions, evidenced these participants’ concern for the respective aspects of the DP. There were a number of comments regarding game-play suggestions that are worthwhile noting at this point, including: facilitators not
having enough time to “make up a story” (VF2), concern that elementary readers (CVC-word level) will not be able to cope with more difficult tasks, like constructing sentences (EF4), and that mere construction play is “too basic” (E3).

As required in the previous feedback iteration, participants were asked whether or not they could see themselves using the DP to facilitate language teaching (see Graph 20). One participant (out of 13, or 8%) did respond that she could not see herself using the product in her typical teaching environment. TF1, who teaches a Grade 1 class at S1 (which caters predominantly to children who experience learning or developmental difficulties), elaborated that the components and lettering are too small, and that, because she teaches “learners that battle with their eyes”, larger blocks and larger content (letters and images) would be preferable. Throughout the product description section, TF1 also commented that “smaller blocks are very likely to get lost especially with the younger grades”, however she did comment positively that the product is “[a] great idea” and that she liked the adaptability offered by the resource. The majority of the participants (12 out of 13, or 92%) could, however, see themselves using the product to facilitate language teaching, in spite of the previously mentioned concerns regarding game-play. Participants elaborated on their responses by indicating that they could see themselves using the product because it appears attractive, understandable, stimulating and enjoyable (E3, EF2, VF2, VF3, TF2-1); it is adaptable to their own, and their learners’, needs (E2, EF3, VF1, VF2, VF3, TF2-2); and because it would enhance the methods they currently use to support language teaching (E2, EF2, TF3).

Once it had been established whether or not participants would hypothetically use the product, they were also asked to gauge the suitability of product-use with regard to: home and educational environments (Graph 21); one-on-one and group learning contexts (Graph 22); and shorter (15-minute) and longer (1-hour) time slots (Graph 23). The product was deemed suitable for use in both home and educational environments by all participants bar one (Graph 21). E2 explained that she does not think the product would be suitable for use in home environments, as she anticipates that parents would have difficulty understanding the game-play and might not be able to facilitate
learning. The product was deemed suitable for use in one-on-one contexts by all participants, and suitable for use in group contexts by most (see Graph 22); however, TF1 did not think the product would be suitable for use in group contexts. This can be attributed to TF1’s previously noted objection to using the product. Elaboration on the topic showed that although TF1 was opposed to using the product herself in a group learning context, she did believe the product suitable for use in one-on-one situations. The suitability of using the product in various time slot durations was contested. Although all participants did believe the product conducive to use in shorter time slots, only six of the 13 participants (or 46%) thought the product would be suitable for use in longer time slots. The researcher had anticipated that this split could be attributed to the nature of the participant groups (key informants, one-on-one facilitators or group facilitators), however, upon reviewing the data, the researcher could not identify any clear pattern to participant responses.

Graph 21: Stacked bar graph indicating participants’ responses (response count indicated in bar end) to the product’s suitability for use in home and educational environments. (Graph by author 2017)

Graph 22: Stacked bar graph indicating participants’ responses (response count indicated in bar end) to the product’s suitability for use in group and one-on-one learning contexts. (Graph by author 2017)

Graph 23: Stacked bar graph indicating participants’ responses (response count indicated in bar end) to the product’s suitability for use in shorter and longer time slots. (Graph by author 2017)

35 One of the two key informants, three of the seven one-on-one facilitators, and two of the four group facilitators rated the product suitable for longer time slots as well as shorter time slots.
4.9.1.2 PRODUCT ASSESSMENT

After participants had provided general feedback regarding their first impressions of the product, they were required to consider the various aspects of the DP. Participants were first required to rate their response\(^{36}\) to the following product design considerations: the various game-play suggestions; the letter and sound content depicted on the blocks; the choice of images depicted on the blocks; the visual style of the images; the storage solution; and the design of the set of blocks. The resultant data is shown in Graph 24.

![Graph 24: Column graph indicating the rating (as a percentage) of the Developed Product according to various product design categories, as per participant feedback. (Graph by author 2017)](image-url)

Despite the similarity between the data represented in Graphs 19 and 24, the former depicts the shift in participants’ first impressions, whereas the latter depicts participants’ considered opinions regarding specific product design considerations. This being said, as with the data represented in Graph 19, the data in Graph 24 shows that the product was generally rated between 4 (80%) and 5 (100%) out of 5, and the product once again scored an average rating of 4.5 out of 5 (90%). Even though the average rating of the data in Graph 24 is the exact same as that of Graph 19, the participant responses to various categories is inconsistent. Most notably, the storage solution is the lowest rated category (with 87.7%) in Graph 19, but the highest rated category (with 95%) in Graph 24. In general, there was a very positive response to the storage system, with participants referring to it as “practical” (E2, VF1), “great” (EF4, VF1), and “compact” (VF1, VF3), and some

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\(^{36}\) Where 1 represented ‘I really dislike this’, 2 represented ‘I like this’, 3 represented ‘indifferent’, 4 represented ‘I like this’, and 5 represented ‘I really like this’.

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stating that they outright “love [it]!” (EF3, VF3). However, EF2 was noticeably concerned that the storage system would be complicated and tedious, and that “[k]nowing how [The Link’s] [existing] games get into a mismatched state (by volunteers)” made her wary of the block-sets remaining in their intended sets. To some extent, these sentiments were echoed by other participants (VF1 suggested colour-coding the blocks to make repacking easier), however VF3 contradictorily commented that, because the blocks fit perfectly into separate storage trays, this was beneficial to product management, as “you can immediately see if any pieces are missing”.

Although the high ratings of the game-play and storage solution categories indicated in Graph 24, as well as the average rating of 90%, reflect positively on the DP, the lower ratings received by the educational content and design of the ‘classroom set’ categories are concerning, as these are the primary features that would be marketed if the product were commercialised. These concerns are exacerbated when participant responses are divided into ‘managerial’ and ‘operational’ participants, as has been done before. The product design ratings depicted in Graph 24 have been split according to ‘managerial’ and ‘operational’ participants in Graph 25. Graph 26 elaborates on this data by providing an indication of which categories were preferred by ‘managerial’ and ‘operational’ participants, and by what margin.

Graph 25: Stacked column graph indicating the rating (as a percentage) of the Developed Product according to various product design categories, according to ‘managerial’ and ‘operational’ participant groups.

(Graph by author 2017)

Graph 25 indicates one decimal point, and uses a minimum bound of 75% instead of 50% in order to exaggerate the difference in ratings.

37 Graph 25 indicates one decimal point, and uses a minimum bound of 75% instead of 50% in order to exaggerate the difference in ratings.
Graph 26 shows that the product design categories that were expected to appeal more to the ‘managerial’ participants, were favoured by the ‘operational’ participants. These are the educational content, storage solution, and block set categories, which are related to the logistical considerations and educational value of the product. Conversely, the categories that were expected to appeal more to the ‘operational’ participants, were favoured by the ‘managerial’ participants. These are the gameplay, image choice and visual style categories, which are related to the use and appeal of the product. Although these findings are not problematic per se, this raises concerns that the appeal of the product might be reduced for the users responsible for purchasing the product, as well as the users responsible for choosing to use the product (since the inverse aspects are appealing to ‘managerial’ and ‘operational’ participants).

The next product assessment question required participants to rate the product (out of 10) according to the design requirements they had previously identified as being most important when it came to the design of an educational toy to support language acquisition. These design requirements were: play-based learning, enjoyability, ease of use for both learners and facilitators, evidencing educational value, being conducive to both individual and group use, durability, multisensory stimulation, understandability and complementing the curriculum. As can be seen in Graph 27, the product was rated relatively highly in all requirements, especially in terms of durability (90.8%), educational value (87.7%), complementing the curriculum (86.9%) and being conducive to both individual and group use (86.2%). On average, the design requirements were rated at 84.1%. The product does, however, seem to be lacking in terms of multisensory stimulation (73.1%) and ease of use for learners (80%), with the former being of notable concern.
Graph 27: Column graph indicating the rating (as a percentage) of design requirements as they pertain to the Developed Product, as per participant feedback. (Graph by author 2017)

Even though the data depicted in Graph 27 shows there is notable fluctuation between the various categories, when the same data is plotted on a radar graph (see Graph 28), the results show that, with the exception of the multisensory stimulation category, the product can nonetheless be considered relatively well-rounded. In spite of the ease of use for learners category receiving the second-lowest rating, it is only the multisensory stimulation category that distinctly warps the decagonal shape of the graph.
It is also worthwhile investigating how participants’ individual responses affected the ratings of the various design requirements, as indicated in Graph 29. Although this graph is not necessarily conducive to ascertaining all participants’ individual responses, the graph does allow for a good overview of responses, and allows for the identification of any outliers. As can be seen in Graph 29, most participants rated the product very highly (as indicated by 99 of the 130 individual ratings being 8 out of 10 of higher), and ratings generally fluctuated within 2 rating points. There were, however, some exceptions. The first is TF1’s ratings of all the design requirements (see the dark purple line; the smallest of all radar areas). Although TF1 had previously indicated that she would not use the product due to the size of the components, her ratings of the design requirements indicate that she was not particularly acquisitive to any other aspects of the product either. Overall, TF1’s ratings scored the lowest average of 5.4 out of 10, and her rating ease of use for learners and durability as 4 out of 10, and her rating enjoyability and use by individuals and groups as 5 out of 10 were particularly concerning. What troubled the researcher most of all, however, was that – in spite of these low ratings – the elaborations and open-ended answers provided by TF1 offered no critical comment on any aspect other than component size. These low ratings were also contradicted by TF1’s general comment that “[t]he idea of the product is great”.

Graph 28: Radar graph indicating the rating (as a percentage) of various design requirements as they pertain to the Developed Product, as per participant feedback. (Graph by author 2017)
The average ratings of all other individual participant responses were over 70%, but there were a number of notable single outlier ratings amongst these. Specifically, EF2 (see dark blue line) rated ease of use for facilitators 5 out of 10, and multisensory stimulation 2 out of 10; VF1 (see dark orange line) rated multisensory stimulation 5 out of 10; TF2-1 (see mid-toned purple line) rated multisensory stimulation an uncharacteristically low 7 out of 10; and VF2 (see mid-toned orange line) rated ease of use for learners an uncharacteristically low 6 out of 10. These independent low ratings contributed to the lower-than-average ratings received by multisensory stimulation (73.1%), and ease of use for learners (80%) as well as facilitators (83.1%). There were no identifiable trends amongst various participant groupings, but it is worthwhile noting that educational value (87.7%) and complementing the curriculum (86.9%) were both rated higher than average, even though educational content had received the lowest rating in the previous data set.
The final product assessment was a repetition of the rating matrix that was posed to participants during the previous feedback phase\textsuperscript{38}, and that had been used to evaluate Concepts 1 to 4. Following the same categorisation and format as before, these results can be seen in Graph 30. The graph shows that the concept was consistently rated very highly across all categories, with only 5\% fluctuation. The DP was rated particularly highly in the educational value and the usability categories (93\% and 92\% respectively), but less highly in the enjoyability and engagement category (88\%). On average, the DP was rated 4.5 out of 5 (90\%) – an average rating that, once again, aligned with the average of the data sets depicted in both Graph 19 and Graph 24.

![Graph 30: Column graph indicating the rating (as a percentage) of the Developed Product according to various categories, as per participant feedback. (Graph by author 2017)](image)

Although the data represented in Graph 30 may seem unnecessary due to the in-depth product assessments that have already been discussed, these findings allow for benchmarking the DP against the original concept directions. Since the DP built on C1 and C4, Graph 31 shows a radar graph comparison of the data represented in Graph 7, Graph 10 and Graph 30. As mentioned before, it is evident that C1, C4 and the DP can all be considered well-rounded products, with slight peaks in different categories.

\textsuperscript{38} Participants were required to rate provided statements as they pertained to the DP, according to the extent to which they agreed with the statements, where 1 represented ‘strongly disagree’, 2 represented ‘disagree’, 3 represented ‘neutral’, 4 represented ‘agree’, and 5 represented ‘strongly agree’.
In order to ascertain a more accurate evaluation, the researcher looked at the same data comparison in greater detail. Graph 32 shows the margin with which the DP was rated higher, or lower, than C1 and C4. Here, it can clearly be seen that the DP outperformed C4 in all categories, with the biggest margins in the understandability and the variety and adaptability categories (with 4.6% and 4.5% respectively). The DP outperformed C1 in the majority of the categories, and scored on par in the usability category, but failed to measure up in terms of the enjoyability and engagement and the secondary user consideration categories. Although Graph 32 is a useful barometer for seeing how the various concepts and product fare against one another, it must again be reiterated that the participants had not been explicitly asked to compare the concepts, and that these anecdotal findings are merely for the researcher to gauge the aspects in which the DP can be improved, by potentially drawing inspiration from earlier ideas.
Graph 32: Column graph indicating the difference in ratings (as a percentage) of the Developed Product in comparison to Concept 1 and Concept 4. (Graph by author 2017)

In conclusion to the online feedback form, the participants were asked to comment on what they did and did not like about the product, and what they thought the product’s potential limitations would be. The participants appreciated the product’s versatility and adaptability (E2, EF1, EF3, EF4, VF1, VF3, TF2-1, TF2-2), the opportunity to make learning activities more enjoyable (E2, EF2, VF2, VF3, TF2-2), the interactive nature of the product (in comparison to activity sheets, posters and flashcards) (E2, EF1, EF4), the storage solution (E3, VF1, VF3), the aesthetics (E2, E3, EF1, VF2, VF3, TF2-2) and the durability of the product (VF3, TF2-1, TF3). Participants were, however, concerned that the longest blocks might confuse learners (E3, EF3), and suggested refining the block-groupings in the various trays (EF4, VF2), as well as the combinations of images and sounds that are represented on each block (E3, EF1).

Participants identified the following potential limitations of the product and proposed game-play: the limited space available on desks for building word-snakes (EF2); product management and the hypothetically time-consuming nature of packing away the blocks (E3, EF2, VF2); the number of users that would be able to use the product in group learning contexts (EF4, TF2-2), the need for constant supervision within the home environment (VF2); and the risk of components going missing (VF3, TF1). Additional commentary regarding game-play included: that children might have to see an example of a game-play activity before understanding what is required from them (E2); the
incorporation of an anticipatory, time-pressure or competitive element (EF1, VF2); increasing the “phonological awareness component for younger learners” (E3); and the integration of a “physical or movement activity” to add greater sensory stimulation (E2).

4.9.1.3 PRODUCT INTERACTION

Subsequent to completing the online feedback forms, all EFs, VFs and TFs were asked to interact with the prototype samples and complete a brief feedback form regarding their experiences. What was rewarding to see is that participants’ opinions regarding the product increased significantly between being ‘introduced’ to the product digitally and being able to physically interact with the product. As can be seen in Graph 33, when viewing the data depicted in Graph 19 alongside participants’ rated responses to the prototype samples, the participant response peaked at 96.4%. This can be attributed to seven of the 11 facilitators (64%) who noted that their response to the product improved after seeing and interacting with the prototype samples. Participants explained that the physical interaction allowed them to “explore how [the product] would be used practically” (EF1), clarified any obscurities with the product descriptions (EF4), and allowed for first-hand experience that confirmed the appeal the product would have for learners (TF2-2).

![Graph 33: Line graph indicating participant attitude (as a percentage) towards the Developed Product in response to product descriptions as well as prototype interaction. (Graph by author 2017)](university-of-johannesburg)

Participants were specifically asked what they thought of the physical size of the individual blocks. This was the only physical product design consideration that the participants were directly asked about, as the researcher had some uncertainties regarding the ergonomics of the components. As can be seen in Graph 34, only one participant (TF1) thought that the blocks should be bigger, but the overwhelming majority (10 of the 11 facilitators, or 91%) thought the blocks were an adequate size.
In conclusion to the product interaction section, the feedback form posed the broad questions of whether or not the product suitably addresses the facilitators’ own needs (secondary users), as well as those of the learners (primary users). All participants responded “yes”, however TF1 responded both “yes” and “no” with regard to the product addressing her learners’ needs. Upon elaboration, she stated that although she could see the product being very successful in one-on-one learning or remedial contexts, the product would only “help 5 out of the 17 [learners] in my class but the others would need it to be less complicated and larger”. She explained that the product may be too overwhelming for learners with special educational needs (LSENs). This concluded the product interaction phase.

**4.9.1.4 PRODUCT TESTING**

The product testing phase was more in-depth than the product interaction phase. Details of the product testing and observation sessions can be found in Appendix F. Although only six facilitators (EF2, EF3, VF2, VF3, TF2-1, TF3) were able to test the prototype samples with learners, this did nonetheless result in 41 learners being part of the testing phase, which was adequate for reaching theoretical saturation. The 41 learners were involved with the product testing during 11 instances, some of which occurred simultaneously. The grade distribution of the participating learners can be seen in Graph 34. Although the learner distribution had no direct bearing on the data, it is necessary to note that the majority of learners (26 learners, of 63%) were in Grade 2\textsuperscript{39}, as this may influence the interpretation of the findings. EF2, EF3 and VF3 specifically commented that their Grade 3 learners were less enthusiastic than their Grade 2 learners, however VF3 explained that this was not atypical and that the younger learners tend to be more excitable.

\textsuperscript{39} Due to the uneven dispersion of learners across grades 1, 2 and 3 (1 instance of 4 learners in total; 5 instances of 26 learners in total; and 5 instances of 11 learners in total) the researcher deemed it unfair to evaluate how the responses for learners in different Foundation Phase grades compared to one another.
Subsequent to using the product as a support resource to conduct their language sessions or classes, the facilitators were requested to complete the second half of the product testing and interaction feedback form (see Appendix I). The first question asked facilitators to rate their learners’ responses to the prototype samples. The responses were either ‘positive’ or ‘very positive’, and the average response was 92.7% (4.64 out of 5). Facilitators elaborated that none of the learners responded to the product with a distinct disinterest, and learners tended to express enthusiasm for interacting with the product. All six of the facilitators who were involved in the product testing phase responded that they would want to use the product again to assist with the facilitation of language teaching, even if no further changes are made to the product. Participants expressed an interest in using the resource again, due to the enthusiasm portrayed by their learners (VF3, TF2-1), the product’s ability to keep learners engaged for an extended period (VF3, TF3) and because of the adaptability the resource offered in terms of conforming to various learner levels, and various learning activities (EF3, VF3, TF3). VF2 also mentioned that she would “like to spend more time working out how best to use it for the different abilities of the students”, thus indicating a willingness to consider additional game-play options (similar sentiments were echoed by TF3).

Facilitators were also required to rate their own, as well as their learners’, experience with using the product. These responses have been represented in Graph 35 and Graph 36 respectively. The DP prototype testing received an average response of 96.7% for the facilitators' own experience, and an average response of 94.5% for how the facilitators interpreted their learners’ experience. It is

Graph 35: Pie chart indicating participating learner distribution (by number and percentage) according to FP grade. (Graph by author 2017)

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40 Where 1 represented ‘very negative’, 2 represented ‘negative’, 3 represented ‘neutral’, 4 represented ‘positive’, and 5 represented ‘very positive’.
41 Where 1 represented ‘strongly disagree’, 2 represented ‘disagree’, 3 represented ‘neutral’, 4 represented ‘agree’, and 5 represented ‘strongly agree’.
interesting to note that the facilitators rated their own experience higher than their learners’ experience, with the exception of the ease of manipulation (physical use) and visual appeal of the product. Although tempting, direct comparisons between the facilitators’ responses regarding their own experiences and that of their learners would not be fair, as facilitator responses are calculated on six completed sheets (one per facilitator) whereas learner responses are calculated on 11 completed sheets (one per testing instance). Furthermore, it is crucial to remember that Graph 36 only represents facilitators’ interpretations of their learners’ experiences, and not the responses that would have been given if learners had rated their experiences themselves.

Graph 36: Column graph indicating facilitator ratings (as a percentage) of their own experience during product testing.
(Graph by author 2017)

Graph 37: Column graph indicating facilitator interpretations (as a percentage) of learner experience during product testing.
(Graph by author 2017)
Participants were able to provide some additional information with regard to their learners’ responses to the prototypes. Facilitators commented that their learners were particularly enthusiastic to tell stories and build words-snakes (EF3, VF3), and recognised that learners “enjoyed the challenge of finding the letters and sounds” (VF2). VF3 mentioned that learners particularly enjoyed interacting with the blocks, as it was “far more exciting than pen and paper work”. Similarly, TF3 noted that the blocks seemed to motivate learners to engage with (and complete) the activity at hand, and that the product allowed learners to “[take] charge of their learning instead of [passively] listening to the teacher”. TF3 further stated that the “learners were enthusiastic as if they were just playing a game”, and made particular mention of how well disciplined the learners were, and how little guidance they needed to complete the exercises. Although most of the facilitators were pleased with the prototypes and enjoyed using the product, there were some suggestions for improvement that specifically resulted from the product testing phase. These included: colour-coding the beginning and ending sounds (EF3), increasing the number of image and consonant-blocks (TF2-1), and including a set of instructions, as well as a list of suggested level-specific words, to assist facilitators who might not be familiar with the product (EF3, VF2, VF3).

4.9.2 REFLECTION

As was done in Phase 7, the researcher reflected upon the data findings, as well her observations of the prototype samples in use by both primary and secondary users, prior to making suggestions for product refinement. The observation instances did not result in any data per se, and are subsequently better suited for discussion under the reflection, rather than the analysis stage of this action research iteration. The researcher predominantly reflects on commonalities that occurred among different observation instances, but also refers to specific examples of behaviour or product use where pertinent. Previous knowledge (gained through secondary research) regarding developmental growth patterns of children, typical behaviour and how children learn, was essential prior to conducting observations, to avoid misinterpreting observed incidences (Lueder & Rice 2008d:403). Furthermore, the researcher is careful not to make any assumptions regarding learner responses that did not pertain to her field of expertise, and speculation is avoided at all costs. The text has been supplemented with images where needed. To best examine the product from a heuristic perspective, the researcher also integrates reflections on the data analysis and participant feedback where necessary, and draws attention to similarities and discrepancies. This section deliberates the researcher’s reflections on product design, product use, product limitations, and user comment regarding the product. Detailed observation notes and additional photographs can be found in Appendix J.

4.9.2.1 REFLECTION ON PRODUCT DESIGN

As mentioned before, it was both interesting and rewarding to note that, even though responses to the product through the online feedback forms were positive, participants were even more
enamoured with the product after having a chance to physically interact with it. Some participants misunderstood that the renders provided in the online feedback form were only meant to be examples, and that the full set would contain more blocks than had been depicted (E3, EF4). It is therefore possible that a number of participant concerns may have been alleviated once facilitators were given the opportunity to interact with the products (since seven of the 11 facilitators, or 64%, had an improved response to the product after they had interacted with it) (see Figure 61 for examples of the prototype samples in use). The researcher further reflects on the product design aspect in terms of the physical components, the product management and storage system, and the content and educational value of the product.

![Figure 61: Examples of the prototype samples in use in the various learning environments. (Prototypes and photographs by author 2017)](image)

**Physical Components**

The researcher paid particular attention to users’ reactions to the choice of material, and to the size of the components. The high-density resin that had been used to cast the prototypes was a good imitation of the PMMA that was proposed for manufacture, and most participants asked the researcher what material the prototypes were made from; some even asked if they were made from wood. Although VF1 had commented in the online feedback form that she “would have preferred to see wood rather than plastic”, after seeing prototypes and experiencing the type of plastic, she seemed more accepting of the researcher’s material choice. Upon seeing the prototypes, a number of participants had commented that the product would definitely be durable, and that they liked the size and weight of the individual blocks. However, the researcher noted that, when carrying a full set
of blocks, the DP becomes very heavy\textsuperscript{42}, and could possibly pose a safety risk. None of the participants raised any safety concerns regarding the product components, or the storage system. An unintentional result of the material choice is that the blocks make a pleasant – if loud – sound when they knock together. This can be seen as both advantageous and disadvantageous as noisy game-play may disrupt other learners in the vicinity (as was the case in one observation instance), but the noise is also likely to provide greater multisensory stimulation.

The researcher was able to ask facilitators directly what they thought of the size of the individual components, and the majority thought they are of an adequate size. The researcher was, however, unable to ask the learners about their experience regarding the comfort and ease-of-use of the blocks, and thus paid careful attention to the physical manipulation of the blocks by the learners. Some examples of the physical interaction with the prototypes have been documented in Table 6. The researcher did not observe any instances that any of the learners had a problem handling one or multiple blocks, even if they had very small hands. A few learners played around with seeing how many blocks they could roll at a time, but learners typically rolled one or two blocks, using either one or both hands. EF3 even incorporated activities requiring the ‘rolling’ of the longer consonant blocks, and (guided by learner behaviour) incorporated the spinning, instead of rolling, of image-blocks. The size of the various blocks can be considered adequate, however direct feedback from learners may provide better insight to product ergonomics.

\begin{table}[h]
\centering
\begin{tabular}{|c|c|}
\hline
Example 1: Learners rolling single blocks. \\
\hline
\end{tabular}
\end{table}

\textsuperscript{42} The set of prototype samples weighs approximately 3.4 kg, and the researcher estimates that each proposed tray would weigh approximately 0.6 kg (excluding the weight of the tray itself).
Example 2: Learner manipulating two vowel-blocks single-handedly.

Example 3: Learners attempting to roll multiple blocks.

Example 4: Learners grasping multiple longer blocks width-ways.
Storage System and Product Management

Although the storage system could not be tested with the users, the researcher noted that a learner from LG2-1 specifically requested if they could “pack the blocks away please, ma'am?”. All four learners proceeded to pack the prototype samples into the cardboard box (that was merely used to transport the blocks) very neatly, and did eventually turn this into a problem-solving activity (one learner suggested to another “let’s make them sleep”, and resultantly lay the blocks down). Upon reflection, the researcher realises that this behaviour was very characteristic of the age group (Grade 3, 8–9), as LG2-2 (Grade 1, 6–7) responded quite differently, and resorted to haphazardly jumbling the blocks together in the box. VF3 had mentioned that packing the blocks into the storage trays would help indicate any missing blocks, and it was interesting to observe how learners made the packing away of the blocks an activity in its own right. Although this gives credibility to the opportunity for incorporating suggestions for game-play that involve the storage trays, the researcher
recognises that LG2-1’s activity differed from the proposed storage system, as the full set of blocks were packed into one box, and they did not require sorting into the various trays.

**Content and Educational Value**

The content and educational support offered by the product was very well responded to. Participants were particularly complimentary of the researcher’s development of the educational content (high frequency words and letters), and the product’s relevance to the SA context (E2, VF3, TF3). The researcher also noted the value of underlining letters and the ‘forced’ horizontal game-play, as it seemed to help learners with self-correcting their use and placement of blocks. EF4 specifically stated that she liked “the way in that it moves from left to right, as one would read, and not up and down, which could be confusing”. The DP seems to have adequately addressed the addition of "more pictures, sounds, [and] categories" that was requested by VF2 in response to C4, as no participants mentioned the need for additional content.

Learners and facilitators alike seemed intrigued by the image-blocks in particular, and would gravitate towards investigating these. TF3 commented that the image-blocks allow “learners [to] learn by association … [and] reinforce learning at a higher level”. During game-play, it did, however, transpire that some of the images should be reconsidered, for example, TF2-1 described the ‘phone’ image as “an old-fashioned telephone”, and most facilitators would check the correct interpretation of images with the researcher before confirming this with learners (for example, the ‘colour splash’ images). It was also interesting to note unintended interpretations of the images by users, for example, SL3-E1b interpreted ‘talk’ as both ‘chat’ and ‘speak’, and SL3-E2a interpreted the ‘thumbs-up’ image (intended to be ‘good’) as ‘shap’ (colloquial for ‘yes’). Although not related to the images, the researcher noted that the word-building activities were a good platform for testing comprehension as well as reviewing homonyms, for example, after building the word ‘grand’ SL3-V1b used it in a sentence as “I am winning a grand”, instead of the expected association of ‘fancy’.

**4.9.2.2 Reflection on Product Use and Game-Play**

During the online feedback form completion, EF1 and EF4 both expressed that they liked the idea of the DP, but that they would want to interact with it in order to fully understanding how it works. The same sentiment was expressed by EF2, EF3, VF2 and VF3 prior to product testing. Although the online feedback forms were a very useful tool to gather data, it is evident that there are some aspects of the DP that simply cannot be adequately conveyed through words alone. The use of the product to support language teaching and learning, and the facilitation of the game-play, lies at the crux of the product’s success; if it cannot be used successfully and effectively, by primary and secondary users alike, it cannot be deemed successful. The researcher reflects on the game-play facilitation, learner response to the prototype, incidental as well as incorrect product use, and the suitability of the challenge posed by the product.
**Product Use and Game-Play Facilitation**

During product testing, the learners were more interested in interacting with the blocks, or engaging with the various activities than they were in the researcher. The products were used in a variety of ways by the facilitators; some of which followed the suggestions provided by the researcher, and some of which were of the facilitators’, or even the learners’, own invention. Almost all facilitators asked how the researcher wanted them to use the product, and it was only with a considerable amount of encouragement that participants thought of their own ways of using the product. The building of individual words and word-snarles, and the telling of stories – both of which were prompted by the image-blocks – were the most prevalent activities. See Table 7 for examples of product use. Facilitators included cooperative and competitive versions of the various activities, and although the learners responded well to the cooperative activities (often helping one another find relevant letters, or breaking up their own in order to share blocks), there was evident enjoyment of the competitive variations. Learners appear prone to turning any activity into a competition, as SL3-V1b proposed to SL3-V1a “[l]et’s see who’s the fastest” when it came to cleaning their white boards, and although TF3’s class activity was cooperative, some learners inherently competed with others to build the longest words, or complete their words first. Learners also seem to enjoy group or paired work, as it provides them with the opportunity to teach (or correct) one other. During almost all sessions, facilitators used the product to facilitate more than one activity. EF3 and VF3, in particular, used the various blocks to support writing activities (on white boards). Although the writing down of constructed words, or using blocks as prompts to write down words that contain a specific sound, do encourage literacy development, these activities restrict physical interaction with the blocks.

![Example 1](image)

LG2-2 being introduced to the product.
<table>
<thead>
<tr>
<th>Example 2</th>
<th>EF2 supervising SL2-E1 building a word-snake.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example 3</td>
<td>SL3-V2a and SL3-V2b building a cooperative word-snake.</td>
</tr>
<tr>
<td>Example 4</td>
<td>SL2-V2a and SL2-V2b building individual word-snakes with communal blocks.</td>
</tr>
</tbody>
</table>
The researcher was particularly intrigued by both sessions facilitated by TF2-1. LG2-1 and LG2-2 were presented with the set of blocks and asked to direct their own game-play; no specific instructions were given. TF2-1 dramatised the introduction of the product, by asking the learners in a hushed voice: “What can you see in the box? A game? How do you think we can use this game? I’ve never seen it before…” Hereafter, the facilitator handed over the product and asked learners to show her how to use the product because it “didn’t come with rules”. The activities were guided by TF2-1 where necessary, yet this approach also resulted in the building of individual words, constructing word-snakes, vocabulary testing and storytelling. When TF2-1 asked LG2-2 how younger learners would be able to use the blocks, one learner responded that Grade R’s could use...
the blocks to “build anything”. This reflected the simple construction play suggested by the researcher as Suggestion 3 for use in a group context. Although the learner-driven transpiration of these activities shows that the researcher has not overlooked any blatant suggestions for game-play, it does make it unlikely that innovative product use will stem from users, and suggests the need for a set of accompanying instructions. This being said, TF2-1 commented that not having any rules “helped a lot”, because she did not have to introduce or explain the product, and the product did not require “setting up for half an hour”. Additionally, the researcher ruminates that by not having any rules accompany the product, it means nobody (facilitators and learners alike) can be ‘wrong’.

TF3’s product testing session is also worthwhile mentioning, as LG3 was the only learner group to test the product in a typical classroom environment, and the learners were engaged in game-play for over an hour\(^43\) (see Appendix J for details). TF3 explained to the researcher that starting with the identification of a sound, then progressing to word-building, sentence-construction, and paragraph (or “story”) writing, allows learners to build familiarity with the word and thus be “inspired” to write the required paragraphs.

**Learner Behaviour and Response to Prototypes**

Most learners showed great interest in interacting with the blocks, especially the younger learners (grades 1 and 2). The researcher observed that the product interaction did not only occur during directed activities, but that learners would also fiddle with blocks while facilitators were explaining activities or while awaiting their turn. Some learners in LG3 were, at first, only interested in looking at the different pictures on the image-blocks, and although it appeared to the researcher that some learners got distracted or had lost interest in the activity, TF3’s observations contested this. TF3 commented that the learners who are generally disruptive were behaving during the session, and she attributed this to the opportunity for interaction posed by the resource and the subsequent activities\(^44\). TF3 elaborated that the learners who usually get distracted had been focused on the activities at hand, and that “even the slowest [learner]” had been engaged and managed to complete the required activity (although it is uncertain whether or not this learner had been helped by classmates).

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\(^{43}\) For the second class activity, learners received their white boards and markers. TF3 handed out all digraphs and instructed learners to write down two words that contained the digraphs that were displayed on the blocks. Once these words had been written down, the learners were required to find the blocks that contained the respective beginning and ending sounds that would complete their written words. For example, if a learner had first received the ‘oo’ block and written ‘school’, they were required to find blocks depicting ‘sch’ and ‘l’. Hereafter, learners had to look for a relevant image-block, or reconstruct their words based on image-blocks they had chosen. Subsequently, learners first had to write a sentence with the word, and then expand their sentences into a full paragraph. Once the sentences and paragraphs were approved by the facilitator, learners returned to their desks to copy their corrected paragraphs into their workbooks.

\(^{44}\) The researcher did note that learner behaviour may have been influenced by the presence of the researcher and not by the resource (Hawthorne effect).
E2 mentioned (in the online feedback form) that learners may need to see an example of the gameplay in order to grasp what is required from them. The researcher found that this did transpire during product testing. During LG3’s session, once a few of the stronger learners had managed to successfully complete the first requirements of the activity, the remainder of the learner group seemed to grasp the concept and followed their example. Similarly, even though VF2 initially explained the game-play concept to the two guest learners (see Appendix J for details), they seemed to rely more on following the examples set by SL2-V2a and SL2-V2b.

Throughout the various game-play activities, the researcher noted some of the learner comments and noted particular enthusiasm for being able to successfully construct words. SL3-V1a commented “Yes! Yes! Yes!” when researcher added the ‘ng’ sound to the learner’s set of blocks (as she had been trying to make ‘bang’ without success), and during LG3’s session one learner exclaimed to their partner “Yes! We got it! Let’s write it!” upon eventually finding a particular block. SL2-E1, who was specifically presented with only vowel and consonant-blocks to start with, gasped and exclaimed “Ja!” (yes) and enthusiastically started sorting through additional blocks (which were requested by EF2, and presented by researcher) to look for new sounds.

Most users (facilitators and learners) responded very positively to the product, however the researcher noted her own uncertainty as to whether learners’ responses were a reflection on the actual product, or on the gamification of learning activities guided by the facilitators. For instance, the researcher noted that SL3-V2b (VF3 learner) appeared bored of a particular activity after 30 minutes had elapsed; he was resting his chin on his hand and glancing around. VF3 did not seem to pick up on this, and the researcher remains uncertain if this was disinterest in the literacy activity, or a lack of enthusiasm for the product. Unfortunately, this can only be ascertained by directly questioning the learners, which this study did not allow for. Some of the facilitators did, however, conclude their sessions by asking their learners if they had enjoyed ‘playing with the toy’ (which is a leading question in itself), and LG3 (Grade 3) responses reflected that they enjoyed “learning how to play”, “helping my friends”, “all the pictures”, “making the story” and “building words”, and SL3-V1a and SL3-V1b (Grade 2) commented that it was a “fun game” and that it was “very smart but so hard”. It is also promising that learners continued ‘playing’ even after their full 45-minute time slot had elapsed, which indicates that learners were genuinely engaged in the various activities (SL2-V2a, in particular, insisted on finishing the construction of the word she was busy with).

**Incidental and Unintended Use**

During the various observation instances, the researcher noted incidental interaction with the product. Although most of these observations showed absentminded fiddling with or holding onto blocks, the researcher also noted that learners would often investigate blocks while their facilitators tended to other matters (SL3-V1a, SL3-E1b), or while they were awaiting their turn to build a word
What was particularly encouraging to see is that while VF3 briefly left to attend to another matter, both SL3-V2a and SL3-V2b grabbed up the image-blocks, rolled these and started telling each other stories / sentences of their own accord. Learners would also use the blocks to test their fine motor skills and coordination, by throwing the blocks in the air and trying to catch them, or by spinning the smallest blocks on a corner, even though there was no clear intention or game-play direction. See Table 8 for examples of incidental product use.

Many learners would bring in an element of construction with the blocks; learners tended to start stacking blocks while they were awaiting their turn, however when EF3 noticed SL3-E2b doing this, she knocked down the tower and made a passing comment about needing to ‘learn’ not ‘play’.
Similarly, during the LG3 observation, one pair of learners (who had completed their sentence writing and were waiting for TF3 to approve their sentences) started stacking their blocks on top of one another, but they sheepishly destroyed their small tower when they realised the researcher was trying to photograph this unintended use of the blocks. See Table 9 for examples of unintended construction play. SL2-E1 was very interested in “building a house”, and instead of preventing this, EF2 opted to incorporate language learning activities alongside the construction play. From simple structures to try build words, SL2-E1 advanced to building larger structures and ended up building a ‘wall’ with all the blocks that were available to her. In order to incorporate a learning activity, EF2 urged SL2-E1 to identify the sounds on the blocks she was placing, whereafter the learner (of her own accord) would provide a word that started with that sound. SL2-E1 was very proud of herself when she had finished her wall and successfully balanced all her blocks, and was very wary of anybody approaching her desk and potentially putting her construction at risk. SL2-E1 showed immense enthusiasm for this activity, but – although not indicative of disinterest as such – EF2 commented that SL2-E1’s “interest in building a tower exceeded her desire to form words” towards the end of their session (30 minutes). The researcher also noted that even though SL2-E1 was still very much engaged with interacting with the resource, her attention span shifted towards entertainment, not educational, interaction, and that the language element gave way to construction play and coordination.

Example 1: The first two structures constructed by SL2-E1.
Example 2: The ‘wall’ constructed by SL2-E1 with all the blocks she had available to her.

Example 3: Examples of learners partaking in construction play while they are meant to be paying attention to the facilitator or other learners.

Table 9: Examples of unintended construction play.
(Prototypes and photographs by author 2017)
During the data analysis in the conceptualisation phase, VF3 had specifically noted her concern that learners might use C4 to “construct things with the blocks rather than [use] them for … vocabulary development”. The researcher found it very interesting to see this activity transpire during product testing, but conjointly it was noteworthy that none of the facilitators identified this as problematic. Although learners did undoubtedly get distracted by this activity, the research reported in the Literature Review encourages simple construction play to aid with language development, and Smith (2002:52) specifically indicates that block-building allows children the opportunity to develop visual, fine-motor, hand-eye coordination, and problem solving skills. Even though language development precedents such as *Conversation Cubes* (see Figure 17) present a limited opportunity for construction play (as there are only six blocks in the set), the DP allows for less restricted construction play, and the various sized blocks present an additional challenge. The researcher does not believe that incidental construction play should be curbed, but that game-play suggestions and opportunities to incorporate language-based activities surrounding construction play should be investigated instead. In cases where undirected or non-academic construction play is viewed as problematic, the prevention thereof would have to rely on the facilitator as opposed to design decisions.

**Incorrect Use**

Although the lack of ‘rules’ meant that there was little opportunity for being ‘wrong’, the researcher did note examples of incorrect use. Some learners did not understand the purpose of the underlined letters, and the most common error was using an upside-down ‘u’ to substitute for an ‘n’ (see Table 10, Example 1). Learners would also often use numerous blocks to create blends or digraphs, instead of looking for the dedicated blend or digraph block (see Table 10, Example 2). Although this is not necessarily incorrect, this did mean that learners ran out of blocks quicker, and they prevented additional word building opportunities. In cases that learners were unable to find the appropriate block, they would propose making a blend using consonants from two adjacent faces, or they would try cover one of the letters on a blend block to isolate a letter, or they would turn the digraph blocks 90° to isolate a vowel. Facilitators generally corrected these mistakes, or would suggest that learners try constructing a different word. Although considered incorrect use, some learners would also attempt building words from top to bottom (see Table 10, examples 3 and 5), and SL2-V2b built three consecutive words that shared the beginning and ending letters (‘peachopot’ which was meant to represent ‘peach’, ‘chop’, and ‘pot’) (see Table 10, Example 4).
Example 1: Examples indicating that learners did not understand the purpose of the underlined letters.

Example 2: Examples of learners in LG3 using numerous blocks to create blends or digraphs, instead of looking for the dedicated blend or digraph-blocks.
Example 3: Specific example showing a number of mistakes by two learners in LG3: ‘oil’ has been misspelt as ‘iol’; ‘ruin’ has been spelt with a ‘u’ and an ‘i’ block instead of a ‘ui’ block; learners have attempted building ‘quick’ from top to bottom; and learners have attempted building ‘swim’ by turning the blocks 90° to the intended position of use.

Example 4: Specific example showing SL2-V2b’s construction of three consecutive words that shared the beginning and ending letters; ‘peachopot’ was meant to represent ‘peach’, ‘chop’, and ‘pot’.
Example 5: Specific example showing two mistakes by SL3-V2a and SL3-V2b: ‘mouse’ was incorrectly spelt ‘muose’ (and was not corrected by VF3), and learners attempted building ‘call’ from top to bottom, instead of left to right.

Table 10: Examples of incorrect product use.
(Prototypes and photographs by author 2017)

It is also worthwhile noting that even though the DP has been developed in such a way that the built words can be read by the learner, this did result in some misspelt words going unnoticed by the facilitators, for instance, ‘mouse’ was incorrectly spelt ‘muose’ and because it was upside-down for the facilitator, this went uncorrected (see Table 10, Example 5). This was also a problem in the cases of LG2-1, LG2-2 and LG3, where many incorrectly constructed or misspelt words went unnoticed and uncorrected, due to the size of the learner groups (see Table 10, Example 3). Although these learners generally did not realise that their words were spelt incorrectly, the word-building activity still seemed to be a self-driven challenge, and learners remained engaged in the activity, and did not seem disheartened even if they required correction (from peers or the facilitators).

**Appropriate Challenge and Suitable Engagement**

The product description presented in Phase 7 indicates that the primary and secondary research provide contradictory information regarding the challenge and complexity that needs to be posed by the product and game play. A number of participants were concerned that the original C4 would be too complex for the learners, yet Smith (2002:63,245) states that by the time learners reach the FP they should have developed the cognitive abilities to “follow directions and to understand step sequences”, and that they should be capable of inventing stories. Concerns were once again raised during Phase 8, by TF1 and EF4, that their respective learners would find the product too challenging to work with, or that the learners would not be able to tell cohesive stories. Prior to product testing, EF2 had also specifically requested “easy pictures” and a selection of only vowel and consonant-blocks for SL2-E1.
Once the product testing commenced, the researcher was impressed with how well the learners performed in the various activities. Most facilitators also appeared surprised by how quickly their learners grasped the concept, or by the difficulty of the words their learners tried constructing (see Table 11, examples 1 and 2). Facilitators seem to underestimate what their learners are capable of, or – at least – what they are willing to attempt. EF2 specifically called the researcher to show her that SL2-E1 had built the word ‘strong’, which appeared to be very ambitious considering the level the learner has been rated as (see Table 11, Example 3). EF2 further commented: “I can’t believe how quickly [the learner] went for this” with regard to constructing ‘strong’. SL3-E2a and SL3-E2b also attempted building ‘butterfly’ which both the researcher and EF3 were taken aback by (see Table 11, Example 4). Although SL3-V1b did not attempt building vastly ambitious words, he expressed great pride in getting his words correct without any help from the facilitator. However, this is not to say that all of the learners completed their activities successfully; during the story-building activity, SL3-E2b (Grade 3 learner) provided a string of sentences, not a coherent story; SL2-E1 (Grade 2 learner) tended to build words with three blocks, and then use three new blocks to build a second word as opposed to building word-snakes; and, when SL3-E2a (Grade 3 learner) was battling to think of words, EF3 asked “[i]s that one too difficult?” and proceeded to find the learner an “easier” block.

Example 1: Examples of correct product use that transpired faster than the researcher and facilitators had anticipated.
Example 2: Examples of advanced product use (using the same blocks to make multiple words, although the second example does contain a spelling error) that impressed the researcher and facilitators alike.

Example 3: Specific example showing SL2-E1’s construction of the word ‘strong’, which surprised EF2 considering the learner is rated on the ‘orange’ level.

Example 4: Specific example showing SL3-E2a and SL3-E2b’s attempt at building ‘butterfly’.

Table 11: Examples of learner product use meeting and exceeding researcher and facilitator expectations. (Prototypes and photographs by author 2017)
After being impressed with the Grade 2 learners during the first observation session, the researcher feared that the product would only prove suitable for Grade 1 and 2 learners, however the DP seems to have provided adequate challenge across all three grades. As mentioned in the data analysis, the researcher did also observe that Grade 3 learners responded with less excitement than the Grade 2 learners. EF3 reassured the researcher by stating that Grade 3 learners are “difficult to impress”, because they do not like repeating what they have done before, and VF3 commented that – despite lower initial excitement – her “top-level learners” (Grade 3) did remain engaged with the resource for 45 minutes, predominantly due to the incorporation of literacy activities, and integration of the longest, three-letter blend-blocks. Between the different grades, the biggest differences were the complexity of the words that were built, the difficulty of the sounds that were introduced, the reliance on image-blocks, and the guidance required from the facilitator. Although VF3 and EF3 merely attributed the less enthusiastic Grade 3 response to the learners’ age, the researcher reflected that it might also be due to the nature of the resource being open-ended, which Smith (2002:67) indicates as being more appropriate for younger learners, as older learners prefer intentional resources with steps to follow to attain a specific goal. Furthermore, Boucher (2008:237) indicates that non-competitive activities, with intrinsic rewards, predominantly appeal to younger children. This leads the researcher to hypothesise that the response elicited from Grade 3 learners could be improved by devising game-play suggestions that reflect competitive, and intentional, aims.

The matter of the product providing a suitable challenge is entirely dependent on the individual learners, and – more importantly – their facilitators. The onus falls on the facilitators to adjust their activities, and chosen set of blocks, to accommodate the level of their learner or learner group. It can, however, safely be said, that the product exceeded the assumptions and expectations of the majority of the facilitators, in the sense that it proves suitable for use in both shorter and longer time slots (provided facilitators introduce and guide a range of different activities), in both group and one-on-one learning contexts.

4.9.2.3 **Reflection on Product Limitations**

The most notable product limitation that presented during product testing, is that the users would run out of blocks with which to build words, more specifically, word-snakes could not be very long, or previously built words needed to be broken down in order to accommodate a new word. This was especially pertinent when two sessions were being conducted simultaneously and the block set had been split between two groups. TF2-2 anticipated that running out of blocks would be a problem in larger classes, however this problem even transpired with groups of as few as four learners. Yet the

45 It is important to note that these observations were carried out in the last quarter of the year. This means all learners were nearing the end of their respective grades and were reaching the point where they were meant to know all that was expected from them for the final assessment.
The researcher was astounded when TF3 used the product in such a way a class of 20 got by with the same set of blocks. LG3’s Activity 2 started out as an individual exercise, but after realising that there would not be enough blocks to accommodate all the learners individually, TF3 divided the class into pairs. Even so, some learners got ‘stuck’ with only two blocks, which did not always allow them to make their intended words. At first, the researcher thought this would be problematic, as it was the weaker learners who inevitably got the ‘last pickings’. Although this was the case, as the stronger learners completed this part of the activity and moved on to sentence and paragraph writing, they no longer needed their letter-blocks, and the weaker learners ended up with a greater selection of blocks that they could use to construct their words. This simply shows that there is no particular need to increase the number of blocks included in the set, and that having an adequate number of blocks is reliant on how the product is used in different contexts.

The second product limitation that was observed by the researcher was facilitators’ willingness, or ability, to incorporate their own suggestions for product use. Even though some one-on-one facilitators had mentioned (during Phase 7) that the researcher cannot rely too much on volunteers to direct game-play, the researcher was surprised that, sometimes, even the participants themselves were hesitant to bring in their own variations of game-play. The researcher realises that she needs to bear in mind not only the confidence and abilities of the learners, but also those of the facilitators. This reiterates the need for providing a leaflet of comprehensive instructions, or suggestions for game-play. It is worthwhile mentioning that the TFs generally appeared more willing to introduce their own methods of game-play, and the researcher surmises that this is likely because they are accustomed to doing this to facilitate their normal classes.

4.9.2.4 REFLECTION ON USER COMMENT

Ultimately, user comment indicates that the kinaesthetic stimulation, the ability to adapt to different learner levels, and the opportunity to accommodate a variety of activities is what appealed most to both learners and facilitators. There is a common, underlying theme that the resource enables facilitators to make learning activities more interesting and enjoyable, for both primary and secondary users, without compromising on the educational value. In addition to this, the product allows for targeting specific language difficulties that learners might have, while simultaneously developing problem-solving, hand-eye coordination, and fine motor skills.

Throughout the observation sessions, facilitators made incidental comments regarding their experiences with the product testing. The one comment that stood out for the researcher was that, when her first session finished, EF2 turned to the researcher and commented “Well, that was amazing”. EF2 elaborated that one would need to find a way to keep the learners focused (after SL2-E1 got distracted by her construction activity) but that “that was fantastic”. TF3’s comments also resonated with the researcher; she commented that she “did activities that [she] never thought were
possible” and specifically noted that the product offered an unconventional source of motivation for her learners that “[added] variety and [gave] meaning to learning through play”, which is precisely what the researcher was striving to achieve.

4.9.3 SUGGESTIONS FOR DESIGN REFINEMENT

Even though the DP conformed to many of the design requirements identified in Phase 5, there are still a number of improvements that can be made to the product to better address both primary and secondary user needs. Bearing in mind the findings that transpired through the data analysis and subsequent reflection, the researcher suggests a number of changes that can be made, in order to further develop the refined product (RP). These are discussed according to: the physical product and the storage solution, the educational content, and the game-play.

4.9.3.1 PHYSICAL PRODUCT, STORAGE SOLUTION AND PRODUCT MANAGEMENT

The size and material choice of the individual blocks does not require refinement, however the distribution of the blocks in the different trays should be reconsidered. Although most participants responded positively to the intended form and function of the storage tray set, the distribution of the blocks amongst these trays was a concern that can be easily addressed. EF1, EF3, EF4, VF2 andVF3 specifically suggested that the various trays be “graded” (VF2) in a way that would make it easier for the facilitators to select a specific tray (instead of choosing a random selection of blocks) that would focus on addressing their learners’ individual need. EF3 suggested that each tray contain blocks to address a different learning level of The Link’s programme (by grouping suitable images and sounds together in sets, and thereby limiting the block quantities), however, EF1 and EF4 realised that the product also has to accommodate learner groups and learning contexts that do not follow The Link’s structure. The researcher, however, appreciates the need for a sorting system that is better thought-out than merely arranging the blocks according to size and difficulty, and suggests refining the block distribution to accommodate incremental learner needs. This refinement should be accompanied by a set of level-specific suggestions for game-play, examples, intended image interpretations, and lists of suitable words. In order to further accommodate the reconsidered distribution of blocks, the researcher also suggests investigating the option of a storage tray variation that can accommodate two layers of blocks. A number of participants raised further concerns regarding the repacking of the correct blocks into the correct trays, if they are grouped according to learner levels. The RP should address this by coding the relevant blocks according to the trays in which they belong (through colour indicators, or indentations on the end faces of the longer blocks).

The number of blocks suggested for the DP ‘classroom set’ does not require refinement. Although some participants (VF2, EF3) commented that the learners were overwhelmed by the number of
blocks that was presented to them during the observation instances\textsuperscript{46}, the same participants had mentioned ‘running out of blocks’ as a product limitation. Furthermore, VF2 specifically indicated that having the full set “is useful for variety and to enable [learners] to build stories”. Since facilitators always have the option of reducing the number of blocks used when working with a single learner, the researcher does not think it necessary to reduce the number of blocks in the ‘classroom set’.

\textbf{4.9.3.2 CONTENT}

Participants responded very positively to the educational content, in terms of both language and images. This being said, the researcher suggests refining the selection of images that is used, to clarify some of the more abstract images (for instance, ‘face’, ‘bird’ and all colour ‘splashes’) and to substitute race-indicative images with emoji-style images, or with characters portraying greater cultural diversity\textsuperscript{47} (see Appendix K). Commissioning of custom images, and a custom font, also allows for better representation of content that pertains to the SA context. This allows for the inclusion of picturable words that are unique to the SA identity (for instance, ‘braai’ (barbeque), ‘gogo’ (grandmother) and ‘robot’ (traffic light)). Although the content development for the DP was a rigorous process, the researcher suggests allowing for longer words that are nonetheless relatively easy to grasp for FP learners (for instance, ‘butterfly’). The researcher also suggests reconsidering the combinations of sounds that are represented on the individual blocks\textsuperscript{48}. The commissioning of a custom font would further increase the relevance of the content to the SA context, considering the concerns raised about the letters ‘q’, ‘t’ and ‘y’ that were used on the DP and prototypes.

\textbf{4.9.3.3 GAME-PLAY}

The game-play of the DP is the aspect that requires the most refinement. The game-play refinement particularly needs to address suggestions to incorporate a competitive element, suggestions for use by large learner groups, and level-specific activities. As can be seen in the data findings, the perceived play-based learning and enjoyability of the DP has been rated below average in comparison to the other design requirements (see Graph 27). EF1 stated that: “The children are captivated by the element of the unexpected, for example in a dice game. They are also more engaged when there is an element of competition, or having to work against a time constraint.” This response demonstrates participant sentiments that the DP does not allow for ‘fun’ activities, and that the lack-lustre response elicited from Grade 3 learners during product testing could be improved by

\textsuperscript{46} To the contrary, SL2-V2a, SL2-V2a and LG3 specifically laid claim to more blocks that had been left unattended by other learners.

\textsuperscript{47} The suggestion to amend race-indicative icons was not mentioned by any participants, and is entirely based on the researcher’s heuristic reflection on the image selection.

\textsuperscript{48} VF1 suggested having “the most common variations of each of the long vowel sounds” (for example, ‘ea’ (meat), ‘ie’ (shield), ‘ee’ (feet), ‘ey’ (money), ‘y’ (funny) and ‘e’ (we)).
developing suggestions that reflect competitive and intentional game-play. Additional game-play suggestions can also be developed around: the packing away of the blocks into the storage trays; the use of only two, three or four blocks; directed construction play; vertical block-placing; ‘underlays’ or activity sheets; comprehension exercises; and basic phonological awareness for younger learners.

DP feedback also pointed to the importance of the inclusion of a set of clear, easy-to-follow instructions, or game-play suggestions, alongside examples and suitable word-building options. The RP requires that these are categorised by learner level, and not contexts of use (as done for the DP) as VF2 noted that her use of the product varied according to the ability of the learner, as opposed to the selection of blocks used. Categorising game-play according to learner level also complements the graded storage trays, as an appropriate instruction leaflet could accompany each tray. These would streamline the learning session for facilitators who are unwilling or unable to incorporate their own game-play (as facilitators do not have to spend time thinking of words or activities); challenge or inspire facilitators who are willing to incorporate their own ideas; and in both cases encourage user buy-in. Instructions should be easily understandable, and accompanied with images or examples, to assist both primary and secondary users in understanding what is expected of them.

4.10 PHASE 9: HEURISTIC PRODUCT EVALUATION

The third stage of the design process commenced in Phase 9. Although the third stage can typically refer to manufacture and production, or full-scale implementation of social interventions, for the purpose of this study, the third stage encompassed the heuristic evaluation of the design intervention and the conclusion of the study. Once suggestions for design refinement were made, the researcher commenced with an objective, heuristic evaluation of the proposed design intervention. The final evaluation of the design intervention (DI) is based on whether it was effectively used and understood by teachers and learners alike (as identified in Section 1.2), as well as the design requirements that guided the product design process (see Section 4.6 and Figure 37).

4.10.1 PRODUCT USABILITY

The DI shows clear evidence of being ‘usable’, based on participant feedback and researcher observations. Although the usability is determined by the users and not the researcher, the data findings show that both primary and secondary users found the DI enjoyable to use and easy to understand. It is difficult to ascertain whether or not the primary users were cognisant of the educational value of the DI (aside from the face value) as they appeared to be more engaged with the game-play and block manipulation than the learning aspect. This does, however, bode well for the requirement of play-based learning, and it was evident that during intentional and incidental product interaction, the learners engaged in creative, imaginative, manipulative and social play.
Although the researcher did not provide the facilitators with specific game-play direction, the archetypal design of the blocks, combined with the underlining of letters, made the fundamental purpose of the DI immediately apparent to facilitators and learners alike. Although the product draws on users’ familiarity with precedents such as Scrabble and Boggle, or even just dice, it still presents a novelty that appealed to all participants. Variety of product use was also prevalent, and was reflected in the different activities that were introduced by the facilitators, often during the same learning session.

4.10.2 PRODUCT FUNCTIONALITY

Where the product usability was determined by the users, the functionality of the product was determined by the researcher. Considerations for universal design elements resulted in the simple, uncomplicated design of the blocks. The requirement for universal design was driven by the development of a solution for those who are “hardest to reach” as opposed to those who are “easiest to reach” to result in a product that is more effective and more extensive (UNICEF 2014a). The researcher cannot ignore the fact that the DI did not appeal to all the participants, and it was not deemed suitable by the facilitator who is responsible for dealing with Grade 1 learners with special education needs (LSENs). Although this can be considered a shortcoming in terms of meeting the universal design requirement, it is important to note that the ‘hardest to reach’ users identified by the researcher were not LSENs, but were learners who came from disadvantaged backgrounds. In light of this criterion, and based on the demographics of the learners who attend S2 and S3, this product can – in fact – be deemed successful on the basis of universal design principles.

In order to be considered age-appropriate, Smith (2002:47) states that building blocks need to show consideration for the motor skills required; number, size and shape of components; materials used; cause and effect; and additional sensory elements. According to these criteria, the product would be evaluated as posing an insufficient challenge to FP learners. However, based on participant feedback, and heuristic reflections on the observation instances, the researcher believes the DI is age-appropriate, and poses an appropriate challenge to FP learners. Furthermore, the DI provides suitable opportunities for product engagement in terms of kinaesthetic stimulation, and the recommendation for incorporating competitive game-play suggestions as per the RP, ought to compensate for the criticism of the DP’s in this area.

The suitability of product use can be considered in three categories: home and educational environments, group and one-on-one learning contexts, and long and short time slots. The research findings of Phase 8 prove the suitability of the DI in group and one-on-one contexts in the educational environment. Although the DI is primarily intended to operate in learning environments, it also has potential for use at home. Home-use did, however, not fall into the scope of this study, and it remains to be seen whether or not the assistive role provided by teachers and facilitators can also be provided.
by parents\textsuperscript{49}. Most participants indicated that the resource could only be used in shorter time slots, but product testing proved the contrary, and the resource was successfully used during both shorter and longer time slots – in group and one-on-one learning contexts. Additionally, the suitability for the SA context is evident in design considerations that implicate the affordability, accessibility, usability, durability and contextual relevance of the product. The DI was developed to be conducive to use in disadvantaged contexts (for example, schools with limited resources), but in such a way that it does not exclude those children who are not affected by poverty or more challenging environments. Furthermore, the content depicted on the product was specifically developed to maximise relevance to the SA context and curriculum.

4.10.3 Supportive of Learning

In order to effectively support learning, a product needs to adapt to individual learner needs, allow for incremental learning and support the development of additional skills. The two former requirements are discussed extensively throughout this chapter, and have featured overwhelmingly as the most popular aspects of the DI. The development of additional skills was also evidenced, in the noting of cooperative play and the sharing of blocks by learners in various instances (social skills) and the overt pride displayed by learners when successfully constructing words (self-confidence). The design requirements did not initially stipulate the development of manipulative skills, but the DI has shown potential for developing fine motor and coordination skills.

4.10.4 Language Development

During product testing, it was noted how easily the facilitators were able to incorporate the DI into their language learning sessions. The DI content was specifically developed around words and sounds that appear in the FP curriculum and should thus allow the resource to ‘grow’ with the learners through the school year and as they progress through the curriculum. Similarly, the DI was developed to address predominant learning difficulties by incorporating vocabulary building (through image-blocks) and phonemic development (through various sound blocks). However, the requirement of addressing multisensory stimulation is the one blatant failing of the DI. Although the researcher had incorporated kinaesthetic and visual stimulation (through block manipulation and images), this did not appear satisfactory to participants. The incidental auditory stimulation that stems from the blocks knocking against one another did not seem to be noticed by participants; and even though the letters were intended to be debossed into the blocks, the failure to replicate this on the prototypes resulted in this design aspect going unnoticed. Although the incorporation of tactile

\textsuperscript{49} This is not necessarily because of parents being unable to follow instructions, but mainly due to the fact that if learners are not exposed to English before entering the FP, then it is very unlikely that they will have a parent at home who is able to instigate verbal, English communication to facilitate the product use. Language development through the DI is not guaranteed unless conversation is actively instigated or encouraged.
surface areas was mentioned by some participants, further investigation as to the specifications of multisensory stimulation would be needed.

Furthermore, the researcher’s greatest dispute lies in the fact that the DI only supports the development of English. Even though the design requirements stipulated that the DI should focus on supporting English, the researcher believes a modular product should ideally accommodate all 11 official languages. A solution that is ‘designed for everybody’, however, runs the risk of being useful for nobody. Since the necessity of English in the SA context was confirmed by participants, the researcher feels English was the obvious choice for the DI. Furthermore, it is important to note that the contextually relevant image-blocks can accommodate the development of any language, as images transcend language barriers. This being said, the transferability of findings allows for the full set of blocks to be adapted to support additional languages. The content cannot be translated directly, as high-frequency letters and sounds need to be investigated and adapted, but the concept can hypothetically accommodate a variety of languages.

4.10.5 Physical Design Requirements

Considerations for the SA context, in terms of physical design requirements, include durability and extending the product’s lifecycle for as long as possible (being adaptable to advancing learning levels), reducing the cost of the product, eliminating the need for maintenance, and being conducive to use in disadvantaged contexts (such as not relying on electricity or batteries, and graphic elements and text being legible in low-light conditions). Furthermore, due to the importance of product safety (see Section 2.4), this was the researcher’s primary concern once a concept direction had been chosen, and was the overarching consideration for determining the size of the smallest components. The size of the individual blocks was deemed adequate by the majority of participants, and as no comments or observations were made that indicated any discomfort or difficulty of use, the physical form of the five different blocks can be considered appropriate. The durability was highly rated, and no negative feedback was received regarding material choice. Due to the prioritisation of product safety, the space limitations regarding product use and product storage had to be compromised. Besides one comment regarding the users’ desk space being a limitation on product use, no negative comments were made in these respects. Although the size of the blocks implicates the space required for product storage, it does mean that the products are easier to locate if dropped or dispersed on a classroom floor. The modularity of the storage trays allows for improved product management and the individual grid layers allow for easy identification of missing blocks. Ease of product maintenance and cleaning as well as environmental impact would only transpire through long-term field testing. The material specification was, however, made in light of these requirements, and ought to be achieved.
4.10.6 Visual Design Requirements

The content depicted on the DI was specifically selected for its relevance to the SA context, so this design requirement can be regarded as successful without the need for additional discussion. It must, however, be noted that the refinement suggestion for commissioning images and a typeface would further increase the DI's SA relevance. On initial inspection, it could be argued that the DI does not fulfil the requirement of being visually stimulating. Although the blocks appear to be predominantly monochromatic (off-white base colour with black lettering) with the only instances of colour appearing on the image-blocks, one cannot disregard the storage trays. The trays would be brightly coloured (as per Figure 51) and, as mentioned before, these would play a bigger role in terms of appealing to users. The monochromatic appearance of the letter-blocks also ensures legibility (even from a distance, as is typical in a classroom environment) which contributes to the DI's usability and functionality, and allows learners to focus on the literacy aspect. Adding additional colour to the DI for the sake of visual stimulation would likely decrease the legibility and, in turn, the usability of the DI.

4.11 Conclusion and Phase 10: Study Resolution

The DP, as presented in Phase 7, differed substantially from what was presented to participants as C4. Yet, the concept of a language-based building block resource remained, and the DP retained tactile stimulation through block manipulation, the ability to support a variety of learning activities, and the ability to support the development of logical thinking and creativity. Furthermore, the DP addressed some of C4’s limitations identified by participants in Phase 6: by providing suggestions for game-play to address the limited creativity and input from secondary users; by providing a modular, compartmentalised, space-efficient storage solution; and by allowing for means of limiting the number of blocks for elementary learners. Participants did, however, still have some reservations regarding the DP, and the researcher’s suggestions for the RP were made with the intention of addressing these. The most notable refinements include: the redistribution of blocks among trays according to learner level; commissioning of images and a typeface; suggestions for competitive game-play; and the inclusion of instructions and examples. The heuristic evaluation in the penultimate phase showed that even though the DI was unable to conform to all the design requirements, it did prioritise most of them. The DI was designed in such a way that it is both usable and functional, that it supports learning and language acquisition, and that it fulfils physical as well as visual design requirements. Resultantly, the DI can be deemed successful within the constraints of this study.

Subsequent to the final heuristic evaluation, Phase 10 concludes the study by summarising the critical findings, revisiting the research question, and making recommendations for further research. These final thoughts are reported in Chapter 5. The concluding chapter illustrates the researcher’s
understanding, interpretation, and addressing of the research problem and the research gap. Furthermore, the resultant design intervention is placed in the context of past research, as well as the study’s findings, in order to reiterate the significance of this study.
CHAPTER 5 – CONCLUSION

5.1 SUMMARY OF CRITICAL FINDINGS

The first part of Phase 10 summarises the critical findings to illustrate the researcher’s understanding, interpretation, and addressing of the research problem and the research gap. To assist with this, the design intervention is placed in the context of secondary research, as well as the study’s findings, in order to reiterate the significance of this study. The principal intention of this study was to explore the design of a product that supports additional language learning and teaching in the FP in the SA context. This was done through secondary research, triangulated primary research, and the UCD of the DI. The primary challenge (according to secondary and primary research) faced by facilitators is that learners are not exposed to English in their home environments, yet they are required to use the language for learning as they enter the formal school environment. Although the secondary research indicates that the majority of SA children receive FP instruction in their mother tongue before switching to English in the IP, it transpired that this was not necessarily the case, and that all learners involved in this study received instruction in English starting from the FP. This means that even though the LOLT is English, and learners are taking English as their HL subject, the language is still considered an additional language for the learners. Due to this limited exposure to English, the predominant language-based learning problems faced by FP learners are vocabulary building, phonemic awareness, and comprehension. The DI focuses on addressing these challenges to support additional language teaching and learning, in both group and one-on-one learning contexts.

The development of the DI was supported by both primary and secondary research, and the study resulted in a product that can be considered successful from the perspective of both learners and facilitators. The DI is suitable for use by learners, as it supports their learning, and their holistic development. The product supports physical development (fine motor skills and coordination), social development (by allowing opportunities for competitive and cooperative play), emotional development (self-confidence) and cognitive development (by encouraging language learning and presenting opportunities for problem solving). The product not only ‘fits’ learners’ current abilities, but also challenges them to improve their abilities through prolonged engagement (as recommended by Lueder & Rice 2008c:322). Since the DI is an open-ended resource, learners are not intimidated by the prospect of ‘not getting it right’, and this encourages persistence; however,

1 Since the DI accommodates for growth (both physical and cognitive) and adapts to learners’ needs throughout the FP, the result is a product with an increased life cycle, in terms of the durability of the physical product as well as the content. This is beneficial to the child (who uses the product longer), the caregiver (who does not need to purchase a replacement as soon) and the environment (since one product can serve its purpose for a number of years).
motivation to succeed is self-driven as there is no directive to activity completion. This being said, the product still allows for the possibility of intentional activities, which would likely appeal to older learners. The adaptability of the product allows facilitators to adjust the tasks they ascribe learners; activities can be made more, or less, challenging depending on the learners’ response to the product. Holt (1983:31) warns that if a play activity starts to focus on specific outcomes or academic evaluation, children are likely to lose interest, however, the open-endedness of the DI balanced the facilitators’ request for an evident educational component, and Holt’s suggestion for refraining from introducing specific academic outcomes. Since the DI allows for non-academic engagement (as in the case with construction play), learners benefit from the development of skills related to block-play and the sub-conscious exposure to the content on the blocks, even when their attention is shifted towards entertainment as opposed to education.

The product is suitable for use by facilitators as it supports a variety of learning activities and can be used to address the predominant language-based learning problems faced by FP learners. The DI also presents as an unusual resource that stimulates kinaesthetic manipulation and encourages learner engagement. The DI is conducive to existing teaching methods and activities, and accommodates some of the shortcomings that are present in SA classrooms. Furthermore, it supports the DBE’s (2015a:7–73) prescribed guidelines for remedial action. Although the responses from the one-on-one and the group facilitators were generally clustered together, there were many differences that do set them apart, but most of these had no bearing on the study. TF3 made a comment that enlightened the researcher to the value that the DP could contribute to the typical classroom environment. TF3 stated:

“I can see myself using the product because presently I use word flash-cards, white boards and pictures, which is not much different from the contents of this product. The advantage of this product is that everything is ready and printed and not time-consuming.”

The one-on-one facilitators who volunteer at The Link generally have all resources and materials provided to them, however, the typical facilitators are required – and encouraged (DOE 2003:36–37) – to develop their own resources. Although the DP is in no way intended to replace the resources developed by teachers, TF3’s comment highlighted the value the product could hold for teachers. This being said, secondary research findings state the importance of recognising that the success of the product relies on the competence of the teachers; the product could enhance a competent teacher, but cannot remedy an incompetent one. LTSMs (like the DI) are important additions to an FP classroom, but it is necessary to reiterate that even though they should be used to support teaching and learning, they cannot be used in isolation, nor can they be used as a replacement for the curriculum or well-intentioned instruction (DOE 2003:37).

Furthermore, although the DI can be deemed successful overall, the researcher is inclined to speculate that – in the long term – it would be best suited for one-on-one support programmes or
remedial teaching, as per The Link’s programme. It is likely that, because the vast majority of participants were one-on-one facilitators, the design direction of the DI was more heavily influenced by the needs of the one-on-one facilitators. TF3 did use the product very successfully in her class, but the researcher remains somewhat doubtful of the likelihood of less capable teachers being as resourceful, or innovative in their use of the DI. The researcher believes that teachers would likely need a lot of additional game-play suggestions in order to actively use the product in classroom environments, and she further fears that without explicit instructions, the product might end up being used merely as building blocks, with only incidental language learning taking place.

In the same way that it is important that the DI (as an LTSM) complements the curriculum and cannot replace it, it is important that the product (as an educational toy) is only a component of play, and that it cannot dictate the nature of play. Hirsh-Pasek (cited by Moretz 2008) stipulates that educational toys need to build on the skills developed by ‘traditional’ toys, and that the product should enable a child to learn something for themselves, and stimulate a child’s imagination, instead of attempting to introduce an unnecessarily complex approach to learning through play. By designing a set of building blocks that depict language elements, the DI propagates the aforementioned advantages of block-play and combines this with language learning\(^2\). Looking back at the secondary research, it is interesting to see that, as warned by Wilson (2016), the facilitators did “underestimate how quickly a child can absorb ideas”, by suggesting activities and content that presented a lesser challenge. The matter of appropriate challenge is a careful balance to ensure a product’s ‘staying power’, since too great a challenge intimidates learners, but too little a challenge does not keep the learners engaged.

On the basis of evaluating the study with regard to addressing the research gap, the DI successfully facilitates the learning – and teaching – of an additional language through creative play, while simultaneously taking into consideration the demands of the SA context. Where the secondary research aided the development of a contextual understanding that allowed for the design of a product that enhances a child’s development, complements the curriculum, and aids in facilitating the learning process, the primary research aided in identifying specific problems that needed to be addressed and directly guided the design direction. Through heuristic reflection on researcher observations and data analysis, the participants’ educational perspective and the researcher’s

\(^2\) Language development through standard building blocks is reliant on the social element that accompanies construction play, since the social engagement, with both peers and adults, allows for verbal communication which inevitably supports the development of language skills (Christakis, cited by Westervelt 2015). Smith (2002:61) also explains that construction play is representational of children’s development because it shows how learners progress from “simply handling objects and materials in their play to actively using them for constructing or building with a pre-conceived plan in mind”. Baring both of these factors in mind, it is evident that the incidental language learning that stems from block play with standard blocks is elevated with the DI, due to the overt language content.
design perspective could be balanced to best guide the development of the DI. The DI addresses the need for a ‘fun’, engaging learning experience, which was missing from the previously discussed *African Voice* resources (SA language development precedents). Although there still are some concerns regarding competitive game-play suggestions, the DI was still rated highly under the enjoyability factor, and allows for creative freedom. Additionally, the active participation of learners can be undertaken individually, in pairs, in small groups and in large groups. Most importantly, the DI allows for incremental learning, and there are myriad ways of using the product to support language teaching. The DI is suitable for the SA context in terms of the physical product, as well as the educational content.

Although the researcher has been critical about some aspects of the DI, it can be considered a successful product overall, both through the heuristic evaluation based on the design requirements, and user response to the product. In spite of some concerns regarding storage, product management, competitive game-play suggestions, and the need for instructions, the general user response has been overwhelmingly positive, as substantiated by some of the comments below:

> “...this is a great game and the suggestions are wonderful” (EF3)
> “Genius tool that will assist at many different literacy levels.” (EF2)
> “I like the product and want to purchase one.” (E2)
> “I just hope that this game doesn’t just remain [your] Master’s thesis, and that it can be produced and used!” (EF4)
> “I think you have done a great job.” (EF2, on email to researcher)
> “The game is looking very good. I showed the pictures to my own children and they said they would definitely have used a game like that.” (VF3, on email to the researcher)

Even TF1 expressed sentiments that the DI was a “lovely” product, but simply not conducive to her and her learners’ needs. Implementation of the refinement suggestions will ameliorate a number of user concerns, but the response from the participants shows that most of these factors would be ‘nice-to-haves’ and are not outright necessities. The researcher and participants both identified the adaptability of the DI – in terms of learner needs, learning contexts and variety of activities – as the product’s most valuable attribute; as this enhances the functionality and usability of the product, and addresses fundamental needs of both primary and secondary users. Furthermore, the DI enables facilitators to make learning activities more interesting and enjoyable for both primary and secondary users without compromising on the educational value; and thereby contributes to the notion of learning through play. As explained by Hirsh-Pasek & Golinkoff (cited by Moretz 2008), the toys that are most beneficial to children are not those that develop one skill in isolation (such as an additional language), but those that also contribute to the development of integrated skills that are relevant in today’s world, such as collaboration, communication, creative problem solving, and confidence.
5.2 Conclusion

The second part of Phase 10 identifies the limitations of the product and the study, revisits the research question, and presents the researcher's final thoughts regarding the significance of this study and the importance of the DI.

5.2.1 Limitations

The limitations presented by this study are discussed as they pertain to the product, as well as the primary research. The research-related limitations that were faced stemmed predominantly from the qualitative research methodology that was chosen, and these subsequently influenced the design direction. Although the reasons for choosing qualitative methods contributed to the strengths of the data, these same reasons posed certain restrictions on the transferability of the data (as forewarned by Labaree 2013).

The first factor to present this irony was the use of a small sample size; although this allowed for conducting in-depth research, it also restricted the variety of opinions that were gathered. The researcher made an argument for the transferability of findings, but using a small sample group is not conducive to making generalisations. In hindsight, there should have been a better balance between one-on-one and group facilitators in order to get more balanced feedback, and the product should have been tested in a professional remedial or therapy environment as well. This being said, the researcher feels that theoretical saturation regarding general learner response (based on observations) was achieved. However, the decision to have more one-on-one facilitators than group facilitators means that the study’s objective drifted to a product that the researcher feels is more conducive to use in a one-on-one learning environment. An additional factor pertaining to sample group selection is that the selection of schools and facilitators directly determined the learners that were involved in this study. S1 was included on the basis that a school catering to learners with remedial needs would allow for accommodating the needs of the ‘hardest to reach’ learners (in terms of universal design requirements), but adding remedial needs over and above considerations for disadvantaged contexts proved unattainable.

The involvement of children also posed limitations to the study. Due to ethical considerations and concerns regarding the validity of responses, the researcher did not directly ask learners for feedback regarding their impressions of the DI. Although the researcher’s hesitation for directly involving primary users was not ungrounded, the feedback from learners might have contributed to a better understanding of their experience with the prototype. As such, there is an opportunity for further testing, but the risk of unreliable feedback remains.
A further limitation presented by the selection of qualitative methodologies was data gathering. Due to the extensive use of open-ended questions (to gather in-depth feedback), and the researcher’s limited experience with conducting primary research, there was inconsistency with regard to the level of detail and the types of responses gathered. Although this resulted in a variety of responses, it proved difficult to find commonalities among answers, and there were many cases of participants contradicting themselves. The data gathering also generated an immense amount of feedback that was very time consuming to analyse and reflect upon, and impacted on the number of design iterations that could be accommodated.

Lastly, since the researcher was the primary instrument for gathering and analysing data, she was personally invested in seeing the product succeed. Although her subjective involvement allowed for design-driven insight to participant feedback, and heuristic reflections, it also meant she was inherently biased, and the analysis and reporting of findings might have been skewed as a result of this. It is likely that a different researcher would have arrived at different conclusions when interpreting the data, and – as is the nature of design – might have designed an entirely different product. Because design was so intertwined with research, and because the findings were very dependent on participants’ subjective interpretations of the product, it means that the full study cannot be replicated; however, it is likely that repeated product testing – under the same conditions – would yield similar responses from participants.

5.2.2 REVISITING THE RESEARCH QUESTION

The research question posed in Section 1.4 asked how the design of an educational toy could support the teaching and learning of an additional language in the FP. This study answered the research question through both research and design. Through secondary research the researcher came to understand FP education in SA, how children learn, design requirements for children. This knowledge guided the design process through deliberation of language development precedents. Preliminary primary research furthered the understanding of the research gap, and identified the specific needs of users with regard to the educational toy. Finally, the design process, supplemented with additional primary and secondary research, resulted in the design of an educational toy (presented as the DI) that was proven – through product testing and participant feedback – to successfully support the teaching and learning of language in the FP.

The DI is primarily intended to support learner proficiency in the most prominent additional language in SA (English) and thereby ameliorate the transition of the LOLT faced in the IP. Although the DBE is attempting to alleviate this problem, there is no ‘product’ available to support the teaching and learning of an additional language that is perfect for the SA context. The DI addresses this gap by providing a physical, three-dimensional resource that supports language development through play. In recent times, ‘play’ is considered by some (particularly parents and teachers) as being less
important than academic achievement or developing functional skills; however, play is fundamental to learning both academic and supplementary skills (MacBlain 2014 ch.3 sect.5; Torres 2008:478). Encouraging learning through play-related products and activities, like the DI, can be hugely successful if children are empowered by allowing them to take control of their own enjoyment. The need for play-based learning was, however, balanced with facilitators' need for the product to have an evident educational element. It is thus, through a combination of play, product and directive language elements, that the educational toy aims to support language learning and teaching in the FP.

5.2.3 CLOSING THOUGHTS

Former SA President, Nelson Mandela (2003), advocated that “[e]ducation is the most powerful weapon you can use to change the world", and the introductory chapter explains that failing to master the basic skills and concepts that are taught during the FP has a cumulative detrimental effect, as each grade and phase builds upon the knowledge attained in the previous year (Gustafsson, Kotzé, Spaull, Van der Berg & Wills 2016:10; Spaull 2016:1). Children from underprivileged schools are subject to an inadequate education (starting in the FP) caused by a combination of factors, including ineffective teachers, and insufficient exposure to the dominating LOLT (Fleisch 2008:138). The DBE’s continuous monitoring and development of the ANAs, and the subsequent intervention strategies, are attempting to ameliorate the problems that face SA education, but in the meantime, educators need to focus on laying a solid foundation for young learners to aid in their future schooling endeavours. Although the DI acts only as an educational aid in the FP, the long-term consequence of additional language acquisition could see greater comprehension of subjects in later education, which may gradually improve learner performance, and eventually contribute to the narrowing of the achievement gap.

The DI is intended support the learning and teaching of an additional language in the FP, but research warns that comprehensive teaching materials and resources are only beneficial if the teachers themselves are competent and use the material in an effective manner (Reeves cited by Fleisch 2008:128). The DOE (2003:37) echoes these concerns by stating that the success of any teaching resource is “determined by the teacher’s ability to use [them] appropriately and effectively in the learning context", and that the “mere presence of [LTSMs] in a learning activity does not automatically mean it is an effective learning tool". Although the DI is a useful, functional and beneficial support resource, the biggest hurdle that faces it, is the possible incompetence of facilitators; the proposed intervention needs to be used effectively, and cannot merely ‘be present’ in the classroom.

Education and human rights activist, and youngest-ever Nobel Prize laureate, Malala Yousafzai (2013) said that education is “the only solution" to solving many of the world’s problems, such as
“[p]overty, ignorance, injustice, racism and the deprivation of basic rights”. She also asserts that it only takes “one child, one teacher, one pen, one book [to] change the world” (Yousafzai 2013). Through UCD and action research, this study addresses the solving of a ‘real’, everyday problem, and the design intervention has the potential to be a part of that change. If developed further, the implementation of the design intervention has the potential to be very successful, and the benefits could go far beyond promoting the ability to adequately read, write, and speak, and could yield results that may influence future generations of South Africa.

5.3 RECOMMENDATIONS FOR FURTHER STUDY AND PRODUCT DEVELOPMENT

The study closes by proposing recommendations for further study, further development and possible implementation. Bearing in mind the limitations that have been identified, and the design requirements that are lacking in the DI, the following suggestions pertain.

5.3.1 STUDY RELATED RECOMMENDATIONS

The recommendations for further study primarily relate to topics that were not adequately addressed through the primary research and product testing. Consideration for these would aid with further design decision making, and would promote the understanding of the research problem and the research gap. The researcher’s principal recommendation lies with the opportunity for further product testing, and gathering more distinctive primary user feedback. Although the study specifically avoided asking learners what they thought of the product (due to the risk of misinterpreting feedback), it could be a possibility to ask learners for feedback alongside an expert on children who would be able to provide insight into their answers. When testing the DI with learners, it would be especially beneficial to ask children directly about comfort and ease-of-use, the challenge posed by the game-play, and impressions of the image-based content, since children might not volunteer this information on their own (as recommended by Lueder & Rice 2008b:220).

The researcher also suggests conducting an in-depth study about how learners respond to the DI according to different grades. This would aid in validating the adequacy of the challenge that is posed by the product and in ascertaining the accuracy of the age-appropriateness. Furthermore, testing the product on learners and facilitators from a variety of backgrounds would provide further insight to the DI’s appropriateness in terms of universal design. The researcher speculated that the product might not be used successfully in the home environment by parents who do not have English as their HL. The DI could, however, still be used by English-speaking parents who want to reinforce language learning at home, and the image-blocks alone could be used to strengthen the HL by non-English-speaking parents. Product testing in the home environment would provide insight into the suitability and feasibility of the product in the home environment.
The product testing phase resulted in an overwhelmingly positive response from facilitators and learners alike, but this could be attributed to the initial novelty of the product, as well as the presence of the researcher (Hawthorne effect). It is therefore recommended to embark on an extended testing phase over numerous weeks in typical learning contexts, to assess the overall success and usefulness of the product, as well as to determine the trajectory of learner interest as they progress through the year. Similarly, it would be beneficial to arrange focus groups with various facilitators to discuss and share how they used the product in order to expand the suggestions for product use. As the storage system was not tested at all, it would be worthwhile investigating the feasibility thereof, especially in long-term use. It would be especially beneficial to see how the storage trays perform in terms of product management, practicality, game-play use, and how the learners themselves react to it.

Since the researcher, as well as the participants, were subjectively involved and invested in the development of the DI, an outsider evaluation of the design intervention could be justified, as the – hypothetical – implementation of the DI would affect the lives of people outside of the sample groups. It is advised to request product evaluation from experts in the field of education that are removed from the study.

### 5.3.2 Design Related Recommendations

Design-related amendments are mainly driven by consideration for the design requirements that were not attained by the DI, and consideration for possible manufacture and implementation of the product. The most discernible suggestion for further product development is to implement the amendments that were proposed as refinement suggestions, and to make final adjustments based on user feedback. As the storage solution has not been prototyped or tested at all, it is also necessary to test and develop this, and to see if it translates into a practical product.

Although the DI has been refined in terms of supporting the learning and teaching of English, there is still potential to be adapted, and the product presents three options for expansion: additional English language content; development of content for other languages; and investigation of the potential for numeracy applications. The suggestion for additional English language content was suggested before, and content could be developed to include sight-words, specific themes, categories, or parts of speech. The adaptation of the content to support the 10 other official SA languages was also mentioned previously. Although the image-blocks can support the learning of any language (including foreign languages, although the content was designed for the SA context), the language-based content that appears on all the sound and letter-blocks would need to be developed for each specific language (for instance, Afrikaans and Zulu), based on frequency of letter and sound occurrence, and to accommodate unique letters. Finally, on suggestion from participants,
the product could also be adapted to accommodate the learning and teaching of mathematics and numeracy concepts.

Before the DI can be considered suitable for manufacture and distribution, there are a number of additional, technical product design considerations that need to be considered. Firstly, the suitability of the proposed materials should be further investigated and tested. This is especially pertinent considering the weight of the prototype samples. Secondly, the suitability of injection moulding and flexographic printing needs to be confirmed by industry specialists. These considerations are conjoined with ensuring the feasibility of the engineering of the various components, as some changes might have to be made to allow for manufacturing and cost restrictions. Thirdly, and most importantly, the DI (including the storage trays) needs to be tested and certified according to the appropriate safety standards (for example, South African Bureau of Standards (SABS) or even Conformité Européenne (CE) certification). The researcher designed the DI to be safe for both intended and unintended users (by specifically allowing for sizes that could safely be used by younger children), but because the product is intended for use by children in educational environments, it would need to undergo stringent safety testing in order to appeal to heads of schools, teachers, parents and potential investors.

This study, and the resultant DI, could potentially gain support and recognition from government departments, private organisations (as corporate social responsibility projects), or education-affiliated charities. If the design intervention is to be realised and pursued in a commercial capacity (as the researcher hopes), a formal costing analysis and market study would be needed. Possibilities for funding models, partnerships or incentive programs, to provide the resource to schools in disadvantaged areas, could also prove advantageous.
LIST OF SOURCES CONSULTED


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A. A HISTORY OF EDUCATION IN SOUTH AFRICA

B. PROJECT OUTPUTS AND DELIVERABLES

C. ACADEMIC UNDERSTANDING OF LEARNING

D. PRODUCT SAFETY

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F.1. DETAILS OF SAMPLE GROUPS

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H.1. CONSENT TO PARTICIPATE: HEADS AND PRINCIPALS

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J. PARTICIPANT FEEDBACK

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J.3. DESIGN CONCEPTUALISATION: RESEARCHER NOTES

J.4. DESIGN DEVELOPMENT: COMPLETED ONLINE FEEDBACK FORMS

J.5. DESIGN DEVELOPMENT: USER INTERACTION AND OBSERVATION FEEDBACK FORMS

J.6. DESIGN DEVELOPMENT: OBSERVATION NOTES

J.7. DESIGN DEVELOPMENT: OBSERVATION PHOTOGRAPHS

K. PRODUCT DEVELOPMENT
K.1. PRODUCT CONCEPTUALISATION RENDERINGS

K.2. PRODUCT DEVELOPMENT RENDERINGS

K.3. LIST OF ICONS USED FOR IMAGE-BLOCKS