AN EXPLORATION OF THE FOUNDATIONAL PROVISION MODEL IN FIRST YEAR MATHEMATICS IN SCIENCE AND ENGINEERING PROGRAMMES.

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Abstract–The changes and transformation in South African higher education and the Mathematics FET curriculum have challenged first year lecturers to review curricular content. The review also comprises a reflection on teaching strategies, use of technology and interventions to support student learning and academic progress. The provision of grants to provide additional resources and interventions has provided opportunities to widen access and deliver tailor-made content in various fields of studies. The number of enrolments in the first year mathematics modules has increased in the past five years but the quality of foundational knowledge and skills has been a concern for all lecturers. Basic numeric skills and critical thinking ability have been identified as inefficient preparation for successful study in first year science modules and need to be addressed at entry level. The University of Johannesburg has designed a semester module in mathematics as a bridging component before students in the four year degree commence, with three semesters to complete the first year curriculum. This investigation compared the success of students in the two streams (three year programme in one module and four year programme in three modules) for the first semester Mathematics and their progress in the last first year modules when students from both streams share the same classes. Appropriate inferential statistics were employed in the comparison of the 2011 – 2013 cohorts. It will be shown that the interventions implemented in the four year degree can be considered as effective in developing the students' academic competency in mathematics relative to mainstream students in Science and Engineering.

Keywords: Mathematics NSC Curriculum; Mathematics Intervention; First Year Mathematics; Critical Thinking; Effective Study Management; Student Academic Support; CAPS

1. INTRODUCTION AND PURPOSE

The changes and transformation in South African higher education and Mathematics FET curriculum have challenged first year lecturers to review curricular content. The review also comprises a reflection on teaching strategies, use of technology and interventions to support student learning and academic progress. The provision of grants to provide additional resources and interventions has provided opportunities to widen access and deliver tailor-made content in various fields of studies.

This investigation comprises a literature review, as well as a statistical analysis to substantiate the challenges faced by first year Mathematics lecturers in terms of larger class groups, lack of prior mathematical skills due to an inadequate matric syllabus and innovative support.

The CHE report (2013, p.43) on new degree duration with inclusion of foundational support raises the poor graduation rate of BSc students (23%) and many students 'dropping-out' with no qualification at all. This research investigates the contribution of an extended Mathematics model to provide students with a comparable opportunity to continue with degree studies.

2. BACKGROUND AND LITERATURE PERSPECTIVES

2.1 Theoretical framework

This investigation will investigate the literature perspectives that influence the performance of first year students in Mathematics on entering the university curriculum. High failure rate has been the norm in most Mathematics first year courses and prevents many students from progression in

Science, Engineering and other programmes (Bunting, 2004, p.73-94) and Jacobs (2010, p. 59-70). Many colleagues at universities are sceptical of the products that schools provide to higher education (first year students) and extending curricula to assist students with transition. The financial loss and resource waste with failing students have been investigated by Scott (CHE, 2013) and urges institutions to design models to combat the drop out of students and promote success rate.

The authors of this paper are of the opinion that the foundational provision model followed by the Faculty of Science has an influence on the successful performance of first year Mathematics students. The theoretical framework that underlies this quantitative inquiry relates to the literature perspectives and research goals to achieve via descriptive, exploration and predictive measurement. The descriptive nature of the research represents an attempt to describe recording of student results after school and at university level, and the incorporation of the literature review on the performance in first year Mathematics. The exploratory nature of the research represents exploration of the curricula (school and university) and the predictive nature of the research represents the prediction of academic success when students exit the foundational provision phase.

2.2 Adaptation of the curriculum

The South African secondary school curriculum, and especially the Mathematics content, has been changed with every new minister since 1994 (Jacobs, 2010). In November 2014, the National Senior Certificate (NSC) will be written on the newly implemented Curriculum and Assessment Policy Statement (CAPS) (DoE, 2011). Changes in curriculum imply new textbooks and resources, with training and up-skilling of teachers, also impacts on the higher education sector where students enter into first year classes. The preparedness of students has been debated widely and will impact on Science, Engineering and Health Science faculties where content follows on the foundations laid down in the school curriculum.

University Mathematics lecturers have been exposed to entering students with changes in school content, creating constant review of first year curriculum. With the removal of crucial topics such as Geometry in the FET Mathematics curriculum-NSC (Jacobs, 2010 and DoE, 2008) from the school syllabus, these learners have been left lacking in their ability to analyse and carry out proofs, such as those embedded in the scientific method of solving Geometric problems. Without a sound knowledge and skill of analysis and applying theorems to solve complex problems, first year students find themselves at a loss when it is expected at higher education level. Experienced lecturers have reported that students in Physics and Engineering programmes are severely affected as they need these critical thinking tools, as well as geometric concepts in their problem solving.

Depth in a topic is sacrificed for newer, easier topics (Kriek, 2008) such as Financial Mathematics and Statistics, which learners find easy. Absolute Values and Reciprocal Trigonometric Functions which had also been removed in the National Curriculum Statement (NSC), are also topics used extensively in the traditional first year mathematics syllabus. Engelbrecht, Harding & Phiri (2009, p. 297-299) have been expressing concerns that this substitution of challenging themes would provide more opportunity for good grade 12 results.

Kriek (2008) and Jacobs (2010) have found that the level at which algebraic techniques is assessed at the end of grade 12 has declined, with ill prepared students enrolling for University mathematics. University Mathematics lecturers investigated first year performance over years and found that students are not prepared to start at the level of mathematics required of them (Engelbrecht, et al. 2009, p. 297-299). For the past ten years universities have been planning and applying interventions, various teaching strategies and tutorial support in their first year mathematics programme to enable students to better cope with the topics covered (CHE, 2013).

In these interventions and support programmes the university curriculum starts with a review of the school content and re-teaching of the important foundational principles from a skilled, mathematical perspective (UJ, 2014). By intervening at the earliest stage possible in the mathematics time-line of students (Jacobs, 2010), many obstacles can be overcome to ensure success on the part of the student. Kurian (2008) indicated that “effective management and leadership is an essential characteristic of a successful school. Institutions that perform poorly require visionary and innovative managers to turn those institutions into centres of excellence”.

In order to improve academic performance, extensive student support needs to be provided. In South African, according to the Education White paper 6 (EWP6), “Inclusive Education and Training is about acknowledging that all children and youth can learn if they are provided with effective support” (DoE, 2001). “The best predictor of student retention is motivation” (Simpson, 2004) which can be enhanced by good teaching and support. Students can be supported by means of passionate teaching, tutoring and extra lessons, as well as being guided by coaching and advice by a caring educator, who is a good ambassador for effective teaching (Tanenbaum; Cross; Tilson and Rodgers, 1998). “Learners need to have access to mathematical knowledge and its structures needed for them to understand their world and decipher ‘unknown information’ about situations (Mwakapenda, 2008) which is the real role of the good university lecturer.

Finally, the criticism of Parker (2006, p.62-63) that ‘the idea of transferability of everyday knowledge into mathematics’ is absent in the NSC, thus placing the transfer of mathematical knowledge and skills to other disciplines at the forefront of importance of good content control.

2.3 Skilled teaching

Kilpatrick, Swafford and Findell (2001) have performed extensive research into the structures needed to promote the learning of mathematics. These structures are conceptual understanding, procedural fluency, strategic competence, adaptive reasoning and productive disposition. The importance of procedural fluency and conceptual understanding (Sullivan, 2010) are actions which are familiar to teachers. In addition, strategic competence and adaptive reasoning might be less familiar actions but can be learnt. However, there seems to be a challenge when it comes to teaching styles to support this, according to Suh (2007).

South Africa has about 24 500 schools and needs a minimum of four to five mathematics teachers per school (this would be 98000 to 122500 qualified Mathematics teachers) and the Department of Basic Education reported that more than a 100 schools have no Mathematics in grade 12, contrary to critics that claim that 327 schools in SA have no Mathematics teacher (Mail and Guardian, 2014). This country desperately needs skilled teachers who are not only qualified in their area of expertise, but also have a love for teaching (Tanenbaum, et al., 1998) There is a deficit of teachers who make it their goal for learners to grasp the concepts and who also inspire them to develop their own self-motivation to succeed. “Empirical studies have shown that the quality of teacher-student relationships tend to decline after students enter junior high school and worsen thereafter “ (Freeman; Anderman and Jensen, 2007).

Mihaly; McCaffrey; Staiger and Lockwood (2013), state that “…teachers matter more to student achievement….” than any other aspect of schooling. The importance of the “right” teacher creating successful learning opportunities can only be accomplished through a high level of skills and knowledge as far as teaching is concerned, according to Mihaly, et al. (2013). Smit (2001) emphasises that “the role of teachers cannot be overlooked if policy and educational change should have the desired effect”.

McGrath; Sayres; Lowes and Lin (2008) maintain that “at the heart of the challenges for FET teacher training is the need to respond to the new curricula, content and learners. These clearly require new pedagogies, including a radical shift in approaches to learner support”. It is essential that teachers be suitably trained in order that they are capable of skilfully delivering the required programmes. Teachers are the largest single occupational group and profession in the country (DoE, 2007). Their role has strategic importance for the intellectual, moral, and cultural preparation of our people, and processes need to be put in place “intended to strengthen the role of teachers”.

2.4 Motivation of students

Educators 'must continually work on inspiring students to become enthusiastic and motivated learners. Such students are engaged, active participants in their own learning' (Parker, 2006). Students need to be inspired enough to ask questions and they should be question-driven, rather than answer-driven (Rothstein & Santana, 2011). New questions generate new ideas and theories which extend the field and grow their depth of comprehension and application. Students need to be stimulated in such a way that their interest is captured and they are prompted to think.

In a report by the Institute for Higher Education Policy (2013) it is argued that answers often lead to an end in merely thinking. The ultimate accomplishment is when an answer leads to further questioning, and these questions in turn lead to further questions. When learners have questions, then they are really thinking and also learning. Teachers should strive to draw questions from students. Our traditional schooling system does not encourage self-thinking and questioning.

In a study by Rich (1997) it is noted that "mega-skills" are needed for successful living in the twenty first century. "Mega -skills includes disciplined work habits, caring attitudes, and the ability to cope, as well as to create one's own opportunities". He ascertained that students need a Life Skills program which runs parallel to their studies in order to cope with the stresses of their academic life. Rooth (1998) emphasis the essence of Life Skills for successful living and learning as it include, amongst others, emotional skills, coping skills, health and hygiene skills, communication skills, and interpersonal skills. Mastery of these skills is what leads to self-empowerment, and then personal growth can occur naturally.

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2.5 Maths Curriculum-CAPS

The new curriculum in the NSC namely the Curriculum and Assessment Policy Statement (CAPS) (DBE, 2014) is still lacking in the level of mathematical skill required for first year university mathematics. The curriculum came into effect in January 2012 for Grades 7 to 9 and Grade 12. Even though geometry has been re-introduced into the curriculum, the level at which certain topics are tested is not adequate for deep understanding of the section of work. The depth of understanding by students is lacking. Even when they follow a procedure, they battle. It is to be understood that they therefore lack understanding on a deeper cognitive level (Felder and Brent, 2005). Students resist detail in mathematics and the teaching at school level is generally not conducive to self-thinking and innovation (Jacobs, 2010).

2.6 Value of Grade 12 results

The higher education sector has found that the grade 12 marks have been inflated (Nel & Kistner, 2009, p. 963). Jacobs (2010, p. 68-70) expresses concern that applications to university are done with grade 11 results and these marks differ substantially from the final grade 12 marks that students submit when they register in their first year. Their inflated marks give them entrance into a program they would perhaps previously never have qualified for and miraculously, on receipt of their matric certificate, they suddenly qualify for these degrees. The drop-out rate of SA universities has been discussed by Scott, Yeld and Hendry (2009), the CHE report (2013) and remains at almost 30% in the first year of studies (Jacobs 2010, p. 70)

Jacobs (2010) tabulated grade 12 results from 2006 to 2009. In 2006 and 2007 25 000 learners passed the previous Higher Grade. In 2008, 89 778 passed in and 85 491 in 2009, but where there is no longer any differentiation in levels. Brombacher (2004,1) and Volmink (2010) found that the average Higher Grade pass rate between 2001 and 2007 was between 6.7% and 7.6 % in comparison to 19.8 % in 2008 and 15.8 % in 2009. Professor Jonathan Jansen (Educational specialist and VC) called it matric fraud (Beeld, 31 December 2003, p.8). "South Africa placed 50th out of 50 countries in terms of quality, participation rate, completion rate and level of competency" (Jacobs, 2010).

The value of the National Benchmark tests has also been debated and although there seems to be merit in using the test with NSC results it seems like university management are reluctant to lose numbers, and enrolment plans drive the incoming numbers, rather than quality and success of students (Jacobs, 2010). The National Benchmark Test has a Mathematical subtest which has been applied in different placement and selection batteries. The results will be provided below and could be used with the NSC results.

3. PROFILING THE UNIVERSITY OF JOHANNESBURG

The University of Johannesburg, in Johannesburg, was established in 2005 when the former Rand Afrikaans University (RAU) merged with the Witwatersrand Technikon and two Vista campuses. It is a comprehensive university with four campuses, nine faculties and over 50 000 students.

3.1 Increased enrolment

As mentioned above, the curriculum has been changed considerably, but not in isolation. The public higher education has been transformed from an elite system with students from good schools to a mass system, and where the sector had 495,356 students in 1994, the numbers escalated to 899,120 in 2011. In the Faculty of Science the profile changed from 264 African and 314 White students in 2001 to 925 African and 108 White students in 2013 (Jacobs and Jacobs, 2014). The Indian and Coloured representation stayed fairly stable over the years and 104 students in 2013. The number of enrolments increased during the years, but given the lack of qualified teachers, the students enrolled and dropped-out ("revolving door") as soon as the first tests and examination were taken down. In the CHE report (2013, p.41) it has been stated that 20% of African and 44% of White students graduate in regulation time. The attrition rate is 40% by the end of regulation time and "…more students have been lost to failure and dropout than have graduated – more than twice as many in the case of African and diploma students" (CHE 2013, 43). The concern would be the low completion rates for Engineering degrees (23%); BSc (23%); Engineering diplomas (5%) and Science diplomas (14%).

3.2 Extended modules

The University of Johannesburg has designed a foundational provision model where students enter Science programmes with the first six months of predominantly school mathematics curriculum, in order to better prepare students for proper first year mathematics. Lecturers find that even standard mathematical procedures are not correctly carried out by students, or unreliable methods are used, which no longer work in the context of more rigorous problem solving. The interventions address these short-comings in adequately preparing students for first year mathematics.

Lecturers find that it takes a few months for these students to realise that they are not quite as capable as what their matric results may claim. Students need to be convinced rather quickly to buy into the program to avoid failure. They also need convincing that they will not be receiving inflated marks and that a pass has to be earned. There is some resistance, but with firm guidance, most students co-operate.

3.3 Interventions

Over and above the change in curriculum and time the extended programme provides interventions to support students towards academic success:

3.3.1 Many of our students fit the profile of the **under-privileged**. They are ill-equipped financially to cope with the challenges of student life. These students have poor nutrition, which directly affects their academic performance. The university relies on sponsors to feed them. Support is also provided in the form of psychological intervention and/or counseling and guidance.

3.3.2 Rigorous **on-going assessment** is crucial to the success of this model. Students need to be persuaded to work on their mathematical skills continuously and the only reliable means is to assess them during almost every lecture. Lecturers find that testing students at the end of a lecture on the new work just covered in that lecture forces students to make it a priority to concentrate, engage and ask questions, knowing they will be assessed before they leave. The benefits of this rigorous assessment far outweigh the administrative hurdles associated with the marking of these assessments. Students are also verbally reminded to commit mathematical concepts to long-term memory. Lecturers find that students generally cannot rely on prior knowledge. They seem to forget the processes which are meant as building blocks for more complex problem solving.

3.3.3 The department of Mathematics relies heavily on the support to students provided by its **Mathematics Learning Centre**. Tutors are available to assist students all day, every day, to assist students who struggle to understand concepts quickly. Tutors are selected for their mathematical ability as well as their communication and teaching skills, by a process of interviews in conjunction with practical mathematics teaching demonstrations. These tutors receive training throughout the year. A logbook is kept of students who make use of the services of the tutors. This service provides one on one assistance to students. In 2013, up to 1600 students per term (64 000 per year) made use of these tutors and the centre (UJ, 2013).

3.3.4 Lecturers and tutors with a **passion for teaching** are selected to present modules. The university finds that knowledge and mastery of mathematics is not enough to get students to a level of understanding of the subject. The teaching aspect of the subject is crucial for successful advancement to the next level. Students require teachers, as opposed to lecturers, who have the success of their students at heart and who constantly innovate in order to adapt to the new student which each year brings forth.

3.3.5 **Technology** is used to appeal to the modern student who is technologically driven in a natural way. UJ uses its own internal website to communicate with, inform and assess students. Students log onto uLink with their student number and receive e-mails of new announcements pertaining to each subject, which lecturers have posted on uLink. The majority of students are comfortable with the use of uLink and those who arrive at university with little knowledge of computers very quickly learn to acquire the skills necessary to participate. Use of uLink is not an option, but a necessity, since the student portal is also used for assessments. Lecturers are also able to post notes of the content on uLink. This particularly useful for topics such as Logic, which is very comprehensive writing and wordy. Students can print out these notes for class and then simply add any comments as the lecture progresses. This leaves more time for the application of the topic in the form of exercises and examples.

4. FOCUS OF THIS INVESTIGATION

This research paper focused on the comparative academic achievement of first-year students in the Faculty of Science at the University of Johannesburg with specific emphasis on the Mathematics modules. The research question is: “Does the foundational provision model in first year mathematics prepare students to pass the main stream module that follows in the second year?” The main objective of this research was to compare the success of students in the three year programme (one module) and the four year programme (three modules). The hypothesis formulated suggests that the interventions implemented in the Four Year Degree programme can be considered as effective in developing the students’ academic competency in mathematics relative to mainstream students.

5. METHODOLOGY

The academic achievement of the three year degree Mathematics students was compared to the academic performance of the four year degree Mathematics students. The curricula of the two programmes are identical; the offering of the mainstream in one module when students exists school are compared with students entering a fundamental module in the first semester and then entering the two semesters (an expanded offering of the main steam one module) before they all enter the final first year module (MAT1B).

5.1 Participants and sampling

Purposive sampling was used with final results of students after completion of the one Mathematics module (mainstream) and final results of students after completion of the three semesters in the four year (extended programme) option for Mathematics 1A. Both these groups streamed into the second semester module 1B and all attend the same class and write the same exam in Mathematics1B.

Table 1 provides a demographic analysis of the participants.

Table 1: Demographic Analysis of Participants

Variable		3 yr (Mainstream) (n=405)	4 yr (Extended) (n=204)
Gender	F	30.6%	40.7%
	M	69.4%	59.3%
Ethnic Group	African	72.1%	91.7%
	Coloured	6.2%	2.0%
	Indian	2.7%	0.5%
	White	19.0%	5.88%
Gr 12 Profile	Ave APS	36.41%	32.39
	Ave Mathematics	74.85%	62.89%
	NBT Mathematics	44.29%	36.74%

5.2 Reliability and validity of the collected data

The date used in this research was the biographical data and grade 12 results as captured on the universities' student data system. The data is reliable and valid as students' results and finances are processed from the same system. The module results were captured from the formal mark system (ITS) and are audited by external auditors and will thus be reliable and valid. The researchers validated each item and removed the students with complete data sets (e.g. international students and students repeating only one of the modules).

5.3 Empirical data

In the dataset, over and above the comparison of the Grade 12 Mathematics results, investigation into the comparison of the achievement in Mathematics 1B, in the second semester (as mentioned above).

A paired-samples t-test, including Pearson's product moment correlation coefficients, were conducted on the two pairs of first and second semester examination and final module marks, for the 846 students who enrolled for the different modules. Tables 3 and 4 below summarise the respective paired samples statistics, correlations and test findings in respect of the two sets of paired differences.

Table 2: Correlations

MODULE		Gr 12 Math	MAT1A01	MAT1AE1-3	MAT1B01
Gr 12 Math	Pearson Correlation	1	.344**	.373**	.356**
	Sig. (2-tailed)		.000	.000	.000
	N	609	405	204	609
MAT1A01	Pearson Correlation	.344**	1	b	.542**
	Sig. (2-tailed)	.000		.	.000
	N	405	405	0	405
MAT1AE1-3	Pearson Correlation	.373**	.b	1	.353**
	Sig. (2-tailed)	.000	.		.000
	N	204	0	204	204
MAT1B01	Pearson Correlation	.356**	.542**	.353**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	609	405	204	609

** Correlation is significant at the 0.01 level (2-tailed).

b. Cannot be computed because at least one of the variables is constant.

Inspection of Table 2 shows the Pearson correlation for Mathematics1A and Mathematics 1B (*r* = 0.356**) is statistically significant (*p* < .001). Furthermore, Mathematics 1AE1-E3 and Mathematics 1B (*r* = 0.353) have a statistically significant relationship (*p* < .001).

In Table 3 the statistics are shown. In the **Mathematics** modules (both programmes) are statistically significant (*p* < .001). The first semester **Mathematics** (mainstream) has as expected lower average of 60.10 (*SD* = 9.521) than the combined results for Mathematics (extended) average of 62.07 (*SD* = 6.977). In the second semester when students from both programmes enter the same modules the values are statistically significant (*p* < .001).

Table 3: Group Statistics

Item	Program	N	Mean	SD
Gr 12 Math	MS	405	74.85	9.277
	EXT	431	61.38	7.804
MAT1A01	MS	405	60.10	9.521
MAT1AE1-E3	EXT	431	58.97	7.81
MAT1B01	MS	405	58.41	10.159
	EXT	205	50.65	9.722

An independent samples t-test was conducted to enquire whether there is a significant difference between the performances of the mainstream and extended in the one module in the second semester.

Table 4: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	**Sig. (2-tailed)**	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
MAT1B	Equal variances assumed	3.120	.078	9.024	607	.000	7.765	0860	6.075	9.455
	Equal variances not assumed			9.150	422.510	.000	7.765	0849	6.097	9.433

In Table 4 the independent samples t-test revealed a statistically significant difference between the mainstream and extended (*t* (422) = 9.150, (*p* = .000),

d =.390), with the marks of **Mathematics** mainstream (three year) (*M* = 58.41; *SD* = 10.159) better than the marks of the extended (four year) (*M* = 50.65; *SD* = 9.722).

Levene's test indicated equal variances for Mathematics1B (*F* = 3.120, *p* =.078, so degrees of freedom were 607.

Table 5: Proportion of Variance In Mathematics 1b Explained By Mathematics 1a (Mainstream and Extended)

Model	*R*	R^2	Adjusted R^2	SE	Change Statistics				
					ΔR^2	ΔF	*df*1	*df*2	Δp
1	.542[a]	.294	.292	8.547	.294	167.814	1	403	.000
2	.353[b]	.125	.120	9.140	.125	28.750	1	202	.000

a. Predictors: (Constant), MAT1A01
b. Predictors: (Constant), Ave MatE1-E3

Table 5 shows that MAT1A results accounted for 29.2% of the variance in Mathematics 1B (ΔR^2 = 0.292; F = 167.814; df = 1, 403; p = .000), and that the MATE1-E3 average accounted for 12.5% of the variance (ΔR^2 = 0.120; F = 28.750; df = 1, 202; p = .000). Thus the MAT1A and MATE1-E3 modules contributed significantly towards the explanation of student achievement in Mathematics 1B, but the mainstream MAT1A accounted for 6.5% of the total variance in Mathematics 1A.

5.3 Empirical synthesis

The empirical investigation among the 836 first year mathematics students generated the following noteworthy findings:

- Table 3 indicates that of the initial 431 extended students only 205 continued with Mathematics 1B (second module) which indicates a 47.6% progress;
- In Table 4 the independent samples t-test revealed that as expected the mainstream (with a mean of 58.41) indeed performed better than the extended group (with a mean of 50.62);
- In Table 5 the variance indicates the contribution that MAT1A or 1AE1-E3 results made towards performance in MAT1B. The 29.2% variance in Mathematics 1B in the main stream (MAT1A) and the 12.5% in the extended (MAT1E1-E3). As expected the main stream 1A should prepare students well to be able to pass MAT1B but there is also a good prediction that students that passes the MATE1-E3 modules would be able to pass MAT1B.
- Thus the extended programme provides students with comparable opportunities to pass first year Mathematics and the modules that follow.
- The model and interventions in the extended programme are providing students with attributes that add to their confidence, work ethics and enough time to mature to transfer the foundational mathematical concepts in other disciplines.

6. CONCLUSION

Based upon the significant (statistically and practically) achievement in the second semester module in Mathematics, the influence of the interventions on student success in Mathematics needs to be emphasised. The research question was: "Does the foundational provision model in first year mathematics prepare students to pass the main stream module that follows in the second year?" The above data- analysis indicate that indeed the foundational provision model prepares students to have an equal opportunity to be able to pass the following module.

The smaller groups, learning centre, active tutorials and highly motivated lecturers are proven to be adding to the attitude and performance of students who started off with a deficit. This paper provided evidence of two streams of students entering the first year Mathematics modules with different background, varying school profiles, excellent and poor teachers and many other factors are provided with an equal chance of passing mainstream modules after applying constructive interventions.

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