PROBLEM-SOLVING TECHNIQUES: A BARRIER IN FINANCIAL MANAGEMENT LEARNING

by

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ABSTRACT

At the University of Johannesburg (UJ), the subject financial management is taught on various programmes across various disciplines. Lecturers find many students struggling with this subject and particularly with applying their knowledge to practical scenarios. If the problem (practical scenario) is not similar to a scenario previously encountered, many students struggle to solve these problems by themselves.

This article will attempt to identify and explain key principles that need to be considered by lecturers in order to improve the problem-solving performance of their students in financial management. Most aspects identified and elaborated on lie within the field of educational psychology. This article will attempt to create an awareness of the key underlying principles of a problem-based pedagogy.

Keywords *Cognition; Cognitive Development; Financial Management; Knowledge Construct; Learning; Metacognition; Problem-solving; Thinking.*

1. INTRODUCTION

At the University of Johannesburg (UJ), the subject financial management is taught on various programmes across various disciplines. Lecturers in this field find many students struggle with this subject, and particularly with applying their knowledge to practical scenarios. If the problem (practical scenario) is not similar to a scenario previously encountered, many students can not solve these problems by themselves.

This article will attempt to identify and explain key principles that need to be considered by lecturers in order to improve the problem-solving performance of their students in financial management. Most aspects identified and elaborated on lie within the field of educational psychology. This article will attempt to create an awareness of the key underlying principles of a problem-based pedagogy, but such principles are by no means a complete guide to improving problem-solving performance.

This article will firstly define problem-solving, and it will then explore why problem-solving skills are specifically important in financial management learning. The learning process, and more importantly the responsibility for this, will then be explored. In the next section problem-solving will be defined as a critical thinking skill which necessitates the exploration of thinking in more detail. At this stage of the article we would have already referred to both cognition and metacognition, and it would be beneficial then to refer to the basics of cognitive development. Knowledge and knowledge construct will be discussed before the importance of knowledge and regulation of both learning and thinking is further explored. Before concluding, this article will specifically refer to important aspects of problem-solving instruction.

Most of the principles identified and elaborated on in this article overlap and as a result there will be some repetition under the various sections.

This article should be of value to both students and lecturers in financial management. However, the article is specifically aimed at lecturers beginning their lecturing careers in the field of financial management.

2. BASIC INTRODUCTION TO PROBLEM-SOLVING

According to Krulik and Rudnick (1980:3) a problem is "… a situation, quantitative or otherwise, that confronts an individual or group of individuals, that requires resolution, and for which the individual sees no apparent or obvious means or path to obtaining a solution". They further defined problem-solving as "the means by which an individual uses previously acquired knowledge, skills and understanding to satisfy the demands of an unfamiliar situation. Students must synthesise what they have learned and apply it to a new situation" (Krulik & Rudnick, 1980:4).

Matlin (2002) argues that problem-solving is an activity (mental or physical) which converts the initial situation (a problem) into a desired situation (a solution). Education-orientated researchers have also defined problem-solving as a process which consists of analysing and resolving a complex situation (Marzano et al., 1988). This process starts with describing the initial situation; it then specifies the goal and also identifies the obstacles which prevent the immediate accomplishment of the goal. In the first step a problem space will be identified, and a course of action will then be searched for, which will modify the initial situation and overcome the identified obstacles leading to the specified goal. The particular selected course of action then results in a solution. Because there may be more than one course of action, the problem-solver will test different solutions for its efficiency (Normand, 2004).

It has been argued that the process of solving problems, which is also a cognitive process, entails clearly identifiable stages or steps. Many generic problem-solving models were developed by different cognitive psychologists using such steps (Normand 2004). Chen (2010:176) states that psychologists have described a cyclical problem-solving process which consists of the following seven generic steps: "(i) Identifying the problem; (ii) defining a mental problem representation, (iii) developing a solution strategy, (iv) organising knowledge/information about the problem; (v) allocating resources for solving the problem, (vi) monitoring the progress toward the goal; and (vii) evaluating the solution for accuracy". Schraw, Crippen and Hartley (2006) suggest a simpler generic problem-solving process with

only four steps, namely: (i) identify the problem; (ii) represent the problem; (iii) select a solution; and (iv) evaluate the solution.

Bransford and Stein (1984) developed the IDEAL model from the research findings of many cognitive psychology researchers. Their IDEAL steps are as follows:

1. **I**dentify the problem
2. **D**efine and represent the problem
3. **E**xplore possible strategies
4. **A**ct on the strategies
5. **L**ook back and evaluate the effects of the activities.

More recently, Facione (2011) also introduced a similar critical thinking / problem-solving and decision-making process called “IDEAS”, which consists of the following steps:

1. **I**dentify the problem and set priorities
2. **D**eepen understanding and gather relevant information
3. **E**numerate options and anticipate consequences
4. **A**ssess situation and make preliminary decision
5. **S**crutinize the process and self-correct as needed

Bransford and Stein (1984), who developed the IDEAL model, stated the importance of their second step and argued that expert problem-solvers represent a problem thoroughly in one or more ways before action is taken, and, if this is not performed, problems are not solved as effectively as possible. Experts also define problems conceptually and in a principle-based manner, whereas novices define problems more superficially (Normand & Baker, 2002).

Problem-solving also entails the use of higher-order thinking skills such as “visualisation, association, abstraction, comprehension, manipulation, reasoning, analysis, synthesis, generalisation – each requiring management and coordination” (Garofalo & Lester, 1985:169).

Problem-solving will be discussed in much more detail throughout this article as it is dissected into its underlying concepts. As an introduction it is important to note that problem-solving is a cognitive process with identifiable steps or stages. This realisation is a crucial first step in the development of an appropriate pedagogy (Normand & Baker, 2002).

The following table presents an additional three generic problem-solving models developed respectively by Dewey, Polya, and Krulik and Rudnick (Carson, 2007).

TABLE 1: Other generic problem-solving models

Developer	**John Dewey (1933)**	**George Polya (1988)**	**Stephen Krulik and Jesse Rudnick (1988)**
Steps	Confront Problem	Understanding the problem	Read
	Diagnose or define problem	Devising a plan	Explore
	Invent several solutions	Carrying out the plan	Select a strategy
	Conjecture consequences of solutions	Looking back	Solve
	Test consequences		

Source: Carson (2007)

3. THE NEED FOR PROBLEM-SOLVING

As a subject, financial management requires a learner to apply content knowledge within realistic, practical scenarios which attempts to replicate practice. The application of content in practical scenarios requires a certain skill set which will become apparent in this article.

This section will specifically explore skills required in practice. In this section, one will see that skills required by employers will ultimately affect the role of educators. Let's first explore the skills required in the workplace by referring to a number of research studies performed.

Montano, Anes, Hassal & Joyce (2001) argue that a gap exists between what practice requires of recently qualified Chartered Institute of Management

Accountants (CIMA) graduates and what educational systems believe to be important. They argue that, as a result, educational systems have been the subject of substantial reform and that the above-mentioned gap can be reduced only if employer needs are clearly understood. Milne and McConnell (2001) suggest that the gap between employer needs and education delivery should be limited and can be done, for example, by providing graduates with the necessary skills through problem-based pedagogies.

Research conducted in 2004 by Mei Tan, Fowler and Hawkes in New Zealand regarding the gap between employer needs and education delivery, specifically investigated which skills and characteristics are rated as most important for entry-level financial managers, by both educators and practitioners. The study was performed by identifying practitioners and academics through a professional association, the Institute of Chartered Accountants of New Zealand (ICANZ). Although the study was performed by a chartered accountancy institute, the study was performed in the subject field of financial management. Their research provided insightful results. Problem-solving, thinking, listening and quantitative skills were rated as the top four most important skills by both the academics and practitioners. Both academics and practitioners ranked problem-solving and thinking skills as the two most important skills required in the workplace (Mei Tan et al., 2004).

Kirkley (2003) argues that economic, organisational, and technological forces have changed the nature of most workplaces. As a result, these workplaces now demand a higher level of higher-order thinking skills than before. Changes in the workplace requiring certain new skills from ‘well-skilled’ graduates are often channelled from employers to educationalists through professional associations (Ballantine & McCourt Larres, 2003). Numerous reports and studies issued by accounting educators and professionals articulate a new set of skills required for the accounting profession. Although these reports list various skills, all include problem-solving ability (Normand & Baker, 2002). Problem-solving is included in various professional curriculums and is not limited to financial management or accounting education. Professional training standards for medical, engineering and business schools are also addressing problem-solving in their professional curriculums (Kirkley, 2003).

Tan (2007) states that problems faced by graduates today are far more complex than in the past, irrespective of the changes in technological, economic and organisational forces as discussed above. Complex problems such as the risk of a possible flu pandemic or environmental disaster exist, as do sophisticated political and social problems. These complex problems require education and more specifically higher education to prepare students for a sophisticated world. The ability to solve a problem when they are plunged into an unfamiliar situation is a reality for workers today (Tan, 2007).

As far back as 1990, the Accounting Education Change Commission (1990) stated that the main criticism of accounting graduates appears to be their inability to identify and solve unstructured problems in an unfamiliar scenario.

Carson (2007) argues that a persistent charge against education systems is that learners are not prepared for sophisticated real-world problems and that education is thus failing in this regard. Given this context, Jonassen (2004:2) concluded that "the only legitimate goal of education and training should be problem-solving".

According to Maher (2000), financial management as a subject itself is also facing a challenging time. One of the reasons for this, he argues, is that executives are downsizing their companies' finance and accounting function. Downsizing is possible due to improvements in data gathering through technology, and threatens the traditional role of accounting and finance people as information providers (Siegel & Sorenson, 1999). Technological changes will have an increasing impact on financial management as the focus moves from data gathering to interpretation. As a result, education will continuously move away from technical content and shift towards non-traditional areas such as problem-solving (Dyer 1999).

It is important to note that the importance of problem-solving skills as part of education is by no means a new concept. Since ancient times, whether it is the early Romans during the time of Cicero or Greek civilisations during the time of Aristotle, there was cognisance that good teaching and learning had to make use of problem scenarios amongst other things (Tan, 2007).

Problem-solving skills have become the way to reconnect content and application in the learning environment as well as the application in various contexts (Carson 2007; Kirkley 2003). Problem-solving is also argued to serve as a core curriculum strand that brings various disciplines, rules, concepts, strategies and skills together (Kirkley, 2003). It is thus not surprising that problem-solving learning (a specific problem-solving pedagogy) has been widely adopted by universities (Kwan, 2008).

It is crucial in this day and age that learners have the ability to gain different perspectives, and develop multiple viewpoints and paradigms. They should be aware of different ways of reasoning and thinking in order to be flexible in their thinking in new and changing environments (Tan, 2007).

4. LEARNING AND THE RESPONSIBILITY THEREOF

As this article explores the vital role of problem-solving skills in financial management learning, it is valuable to define and explore learning itself. It will also become apparent that the responsibility for learning plays an important role in the problem-solving learning process.

Learning is a process which takes place when experiences permanently change a learners' individual knowledge or behaviour (Biehler & Snowman, 1993; Woolfolk, 1998).

The understanding of human learning has evolved dramatically over time as a result of research in multiple disciplines such as psychology, cognitive science and education (Bransford, Brown & Cocking, 1999). It has evolved from a behavioural approach, where learners passively receive knowledge, to a cognitive approach, where learners actively construct knowledge (Eide, 2000). Thus the outcome of learning should not depend mainly on what the teacher presents (teaching strategy) but rather on what the instructor presents jointly with the learner processing this information (through learning strategies) (Eide, 2000). Information is processed by learners through paying attention to the information, recognising and transforming it as well as memorising and later retrieving it. Learners now store mental structures of organised knowledge, which are known as cognitive structures. Cognitive learning

places greater emphasis on individual learners: they are no longer passive receivers of information but rather active participants in the learning process (Eide, 2000; Snyder & Snyder, 2008). A cognitive learning strategy can be defined as: “Skills of self-management that the learner acquires, presumably over a period of years, to govern his own processes of attending, learning and thinking” (Gagne, 1974:4). Riding and Powell (1993) argue that a learning interaction should not consist only of the content of learning but should also contemplate the process of learning as well.

Gibbs (1992) state that far too many students feel lecturers are responsible for their learning (rather than they themselves), because lecturers select, present and test whether content has been retained. Clearly, teaching must be an active process in which the responsibility for learning is transferred to the student. It cannot be an experience for students whereby they only receive information, as Anderson and Taylor (1994:44) state: “No matter what approach is taken in the lecture hall, learning should never be a spectator sport”. In a situation where students do not take responsibility for their own learning, information is unlikely to be converted into knowledge.

Breton (1998) stated that many disciplines, noticeably medicine and law, have undergone a significant teaching reform. The tendency of such reform is the increased participation of students in the learning process. The Accounting Education Change Commission (AECC, 1990:309) states that “students must be active participants in the learning process, not passive recipients of information” and “Learning by doing should be emphasized”.

Huba and Freed (2000) argue that a paradigm shift is taking place in education – methods are moving away from traditional teaching (where teaching is seen as the central focus), to methods whereby students are actively involved in the learning process. The teaching-focused paradigm is where the lecturer are considered as knowing everything, and students then passively receive information and acquire knowledge, but no connection is made to the context in which the knowledge will be applied (Huba & Freed, 2000). The learning-centred paradigm is where “Students construct knowledge through gathering and synthesising information and integrating it with the general skills of inquiry, communication, critical thinking, and problem-

solving" (Huba & Freed, 2000:5). Barr and Tagg (1995) also elaborated on this matter by stating that education is moving from an "instruction paradigm" to a "learning paradigm", as tertiary institutions exist to produce learning rather than to provide instruction.

A clear principle emerging from of a 'learner-focused' pedagogy is that the responsibility for learning lies with the student and not the lecturer. The idea that students should take responsibility for their own learning is now widely accepted in education (Breton, 1998).

It is important to realise that the shift in focus from the teacher (instruction) to the learner (learning), as well as the responsibility for learning lying with students, does not take away the importance of guidance given to students. Van den Brink, Kokke, De Loo, Nederlof and Verstegen (2003) highlight that guidance is of the essence in a problem-solving teaching strategy. De Corte (1990) described a powerful (cognitive) learning environment as being characterised by a balance between discovery learning and personal exploration on the one hand and then systematic instruction and guidance on the other (McGuinness, 1993).

Powerful (cognitive) learning environments consist of students observing experts performing a task (modelling), and learners getting hints and feedback on their own performance (coaching) as well as direct support (scaffolding) during the initial stages of the task. They must also move gradually to self-regulation (fading) (McGuiness, 1993).

Educators need to benefit from the traditions of behaviourism, social learning, and humanistic as well as cognitive psychology and respect the multiple perspectives of learning rather than adopt a one-size-fits-all model (Tan, 2007).

To conclude, a financial management lecturer should ensure that his/her learners fully understand what learning entails, as well as the specific role of both the learner and teacher within this process.

5. EXPLORING THINKING

Solving a problem entails the use of higher-order thinking skills (Garofalo & Lester, 1985). I will now explore thinking, critical thinking, cognition and metacognition in order to understand how problem-solving skills fit into these important concepts. It will become apparent that it is crucial for both the financial management learner and teacher to be aware of and understand these concepts in order to understand how problem-solving skills can be improved.

When exploring thinking and how its quality can be improved educationally, one needs to explore the nature and function of thought. Although one realises that different forms and quality of thinking exists, the mental processes and mechanisms of thinking (cognition), whether from a philosophical, psychological or neurophysiological view, are difficult to identify and understand. However, it is crucial that the nature and function of thinking are understood in order for them to be improved (Riding & Powell, 1993). Thinking skills are also the basic tools of effective thinking (Beyer, 2008).

Thinking can be defined as “an active, purposeful organised process that we use to make sense of the world” (Chaffee, 1990:1,37). Critical thinking, on the other hand, can be defined as “making sense of our world by carefully examining the thinking process in order to clarify and improve our understanding” (Chaffee, 1990:1,37). Critical thinking is also seen as a higher-order thinking skill (Magno, 2010).

Many critical-thinking definitions which elaborate more on specific skills within critical thinking mention problem-solving skills directly as a critical-thinking skill. Let’s explore some of these definitions. Chaffee (1992:25) explained that critical thinking skills involve: “solving problems, generating and organising ideas, forming and applying concepts, designing systematic plans of action, constructing and evaluating arguments, exploring issues from multiple perspectives, applying knowledge to new situations, critically evaluating the logic and validity of information, developing evidence to support views, carefully analysing situations and discussing subjects in an organised way”. Kimmel (1995) also stated that critical thinking is the process of

evaluating a problem situation to arrive at a justifiable solution while synthesising all information.

It's becoming evident that critical thinking involves the thinking process itself. Before we explore this concept further let's first discuss cognition and metacognition.

"Cognition includes skills necessary to encode, memorise and recall information. Metacognition includes skills that enable learners to understand and monitor their cognitive processes" (Schraw et al., 2006:112). Simply put, metacognition refers to knowledge about cognition, or cognising about cognition (Roberts & Erdos, 1993), or, put even more simply, thinking about thinking (Flavell, 1979).

The distinction between cognitive and metacognitive activities has been unclear and various researchers are of the opinion that they may be dependent on one another and therefore cannot be entirely separated (Flavel, 1979; Veenman 2006). Ku and Ho (2010:253), however, stated "that the difference lies in the goal of the activity: cognitive activities help to acquire, retain and transfer knowledge for task execution, whereas metacognitive activities or strategy allow one to regulate and govern task execution".

Metacognition involves appraising your current knowledge, understanding the learning task at hand and taking cognisance of the knowledge and skills required together with the alertness to make correct inferences as to how to apply your knowledge to a specific scenario and to do so efficiently and reliably (Taylor, 1999).

Metacognition is also a core component of higher-order thinking (Ku & Ho, 2010). "Higher order thinking (like critical thinking) requires executive control and executive processes (that comes in the form of metacognition)" (Magno, 2010:149). It is meaningful at this stage to note again that problem-solving skills can be defined as a higher-order thinking skill (Chaffee, 1992).

Needless to say, educationalists should understand cognitive psychology in order to be successful at implementing problem-based learning pedagogies (Tan, 2007). It is

thus crucial for the financial management teacher to take note of these concepts when developing or executing pedagogies.

Now that cognition and metacognition have been defined, let's explore critical thinking further by referring to definitions and statements in order to relate it better to cognition and metacognition. "Critical thinking demands strategic use of cognitive skills that best suit a particular situation, as well as an active control of one's own thinking processes for well justified conclusions" (Ku & Ho, 2010:251). Critical thinking occurs only if we understand how our cognition functions in order to develop related knowledge and skills in comprehension, reasoning and various other forms of higher-order thinking (Ku & Ho, 2010). Critical thinking takes place when an individual uses cognitive skills and strategies which increase the probability of a desired outcome (Halpern, 1998). Finocchiaro (1990:465) stated that "Critical thinking is thinking which is reasoned, evaluative and self-reflective". Sternberg (1985:46) defined critical thinking skills as "the mental processes, strategies and representations people use to solve problems, make decisions and learn new concepts". According to Magno (2010:137), "Developing students' critical thinking skills is facilitated through metacognition". Magno (2010) also stated that critical thinking is a product of metacognition. Brown (2004) made the comment that without metacognition it would be impossible to think critically. Tempelaar (2006) stated that critical thinking can also be referred to as metacognition.

Regulation of cognition (metacognition) includes at least the following three components: planning, monitoring and evaluation (Scraw, Crippen & Hartley, 2006). Metacognitive strategies are thus broken up into planning, monitoring and evaluation, which form the three dimensions of a metacognitive strategy and are a crucial variable during the thinking process. A critical thinker is in charge of his/her thinking process, and a metacognitive strategy enables this control (Ku & Ho, 2010).

Let's further explore how thinking skills may be improved in order to understand how teachers may attempt teaching/improving thinking skills in financial management. Thinking skills are made up of different components, including cognitive procedures, strategies and routines (Beyer, 2008).

The thinking procedures, strategies and routines of expert thinkers can be used to teach procedural steps to students in order for them to become better thinkers. It is crucial that these steps are made explicit to learners (Beyer, 2008). It's the role of the teacher to ensure that students recognise the state, repertoire and depth of the various dimensions of their thinking. Visibility of cognition (which teachers should facilitate) is a prerequisite for effective mediation and facilitation. A desired pedagogy should not only make content knowledge visible but also teachers' as well as learners' thinking visible (Tan, 2007; Beyer, 2008).

Although thinking improves over time as a result of experience and does not occur instantaneously, it doesn't develop through maturity alone, and it also doesn't occur simply as an outcome of subject-matter learning. Thinking skills require more than indirect teaching or self-discovery. Researchers have found that repeated, systematic, direct instruction about thinking skills can enhance proficiency significantly (Beyer, 2008).

Direct instruction entails a detailed, step-by-step strategy, including when and how to use a certain skill. It also includes feedback and coaching (guidance) throughout the instruction thereof (Beyer, 2008).

Direct instruction must occur over time, through different contexts or subjects until proficient. This process would entail an entire circular process until the required proficiency level is acquired by the learner. The direct instruction process can be divided into modelling, coaching and lastly fading when the proficiency level is reached. Continuing instruction over an extended period of time in different contexts facilitates transfer (applying skills in different contexts) of these skills. In order to improve transfer, students need to apply thinking skills in various contexts. It is useful when the teacher guides students to predict occasions when this skill can or cannot be used (Beyer, 2008).

Cognitive teaching strategies ultimately take the form of both problem-solving and critical-thinking strategies (Schraw et al., 2006).

Tan (2007:106) states that “the role of a teacher is to enable students to recognise the state, repertoire and depth of various dimensions of their own thinking and to sharpen their abilities to deal with real world problems”.

It is crucial for financial management teachers to teach their students to think, as it is now evident that thinking skills can be improved through direct instruction. Cognitive development will be further explored in the following section.

6. COGNITIVE DEVELOPMENT

The ultimate goal of education should be cognitive development (Brazelton, 2000). Tan (2007) argues that education entails the equipping of learners with the cognitive and socio-emotional skills to ensure they are adaptable in a fast-changing world.

It should now be apparent that problem-solving skills (which are defined as a critical thinking skill) form part of cognition. Thus in this section cognitive development will be further explored, as both the financial management learner and teacher should be aware of how cognition develops.

Cognitive development refers to the changes which takes place in a learner’s thinking patterns over a period of time. Cognitive development also takes place in hierarchical stages. Bloom (1956) argues that student learning takes place in six cumulative stages of cognitive development, which he based on the level of cognition required to perform a specific task (Brazelton, 2000).

The main purpose of Bloom’s Taxonomy is to differentiate between memorised knowledge and activities requiring different abilities and skills. It is also crucial to note that one of the foundations of Bloom’s Taxonomy (Bloom, 1956) is that knowledge forms the basis of all cognitive processes. Knowledge, as a result, forms the lowest taxonomic level of Bloom’s Taxonomy, as it’s required for all subsequent levels. This also emphasises the importance of gaining knowledge of financial management, which will be discussed in the next section of this article. Bloom’s taxonomic levels are the following: knowledge, comprehension, application, analysis, synthesis and, finally, evaluation (Brazelton, 2000).

It is important to note that the intention of Bloom's Taxonomy is to control instructor input: it can be used as a means of ensuring that a teaching approach is planned and properly structured. Bloom's Taxonomy also enables instructors to monitor and evaluate students' learning and also provides a structure to teach critical thinking. Instructors must guide learners to progress from the lowest to the highest level of learning (Brazelton, 2000).

Piaget (1956, 1959) investigated the internal world of the learner in relation to intelligence and questions regarding the structure of mind (Tan, 2007). He based his work on three interrelated concepts: relation between action and thought, the structuring of cognitive constructs and, lastly, self-regulation. Piaget argued that the highest form of cognitive development is when logical thinking and reasoning about complex problems takes place (Tan, 2007).

Piaget also argues that instructors should take note of the learner's stage of development in order to develop more complex thinking in stages (Brazelton, 2000). Piaget's developmental theory argues that the development of our reasoning ability affects our ability to deal with more complex problems. The ability to process information depends on the maturation level and the cognitive structures that filter the information. The ability to solve complex problems develops with maturation and experience. Piaget classified cognitive ability into different levels, the highest two of which are concrete operational (lower level) and formal (higher level) operational (Jones & Davidson, 1995).

Research found that university students from different years differ in their cognitive development. This indicates that the cognitive level of students changes during university years. The changes were more apparent in the first two years (Eisert & Thomlinson-Keasey, 1978; Bateman & Donald, 1987).

Kurfiss (1988) argues that the most beneficial approach to developing critical thinking is to make use of cognitive development models. Instructional methods which promote construct understanding promote deep learning through improving cognitive load (Chen, 2010).

Amernic and Beechy (1984) investigated the relationship between learners' cognitive level and their performance in structured and unstructured problem-solving. They found that learners with a high cognitive level outperformed students with low cognitive levels in unstructured problems, but performed the same in structured problems.

The financial management teacher should be conscious of the fact that his/her learners are at different levels of cognitive development, and that cognition develops in stages.

7. KNOWLEDGE AND CONSTRUCTION THEREOF

Problem-solving depends on the deep structures of knowledge (Palumbo, 1990). Carson (2007) argues that critical thinking and problem-solving must include a knowledge base, as it enables application of conceptual knowledge or transfer to take place.

Before the importance of knowledge and knowledge construct are further explored, the meaning of learning, knowledge and information must be laid out. According to Eide (2000), learning evolved from an approach whereby learners passively receive knowledge to an approach whereby learners construct their knowledge. Knowledge is created when one actively processes the information, thinks about it and reasons it (Isakovski, 2005). There is a logical and important difference between information and knowledge. Information will become knowledge only if the information was reasoned and thought though. It must be interpreted and must also be seen within a conceptual framework (bigger picture) (Isakovski, 2005). Financial management teachers should guide their learners on how to convert information into knowledge.

The importance of topics and techniques within financial management being fully reasoned (understood) can be facilitated, for example, by guiding learners to consciously asking themselves "why" instead of "how". Learners tend to focus on "how" to perform a financial management task instead of reasoning and fully understanding "why". When learners consciously ask themselves "why", they force themselves to reason what they are doing during the learning process.

Norman and Schmidt (1992) emphasised the importance of a learning context in order to gain knowledge. It must be seen within a conceptual framework ('the bigger picture'). Many financial management courses treat techniques/topics in isolation. When these topics/techniques are studied independently, it is questionable whether true knowledge will be gained (Scapens & Arnold, 1986). Scapens and Arnold (1986) state that textbooks often emphasise the inner workings of techniques rather than the reasoning behind these techniques/methods, the circumstances in which they can be effectively used and the background of these techniques. Van den Brink et al., (2003) argue that this results in students thinking that financial management is just a mixture of certain 'tricks of the trade', resulting in them not seeing these techniques/methods in context. Researchers also concluded that knowledge of context is the most critical feature of skill in problem-solving (Kirkley, 2003).

It is therefore important not only to realise that students must fully understand financial management, but that they must also see the specific techniques/methods in a conceptual framework. In other words, students must fully understand the 'bigger picture' and where/how various topics fit into this bigger picture. When this conceptual framework is not apparent students will not fully understand the subject matter and problem-solving will thus be tedious. The lecturer's responsibility is therefore to ensure that students are equipped with a conceptual framework and both students and lecturers must be aware of the importance of understanding the subject matter within a conceptual framework in order to facilitate knowledge construction.

Successful problem-solving requires a knowledge base, and problem-solving results in knowledge transfer (Carson, 2007). To gain knowledge one must also think: thus thinking, knowledge and problem-solving are interconnected (Carson, 2007). Riding and Powell (1993) argue that thinking consists of knowledge, cognitive style and intellect. Peikoff (1985) argued that that there is no way to separate thinking or problem-solving from knowledge. Peikoff (1985) further stated that a knowledge base enables problem-solving through the application of knowledge or transfer. Many instructional textbooks also stress the importance of content knowledge in solving problems (Carson, 2007).

Academic programmes with an instructional strategy whereby creative and critical thinking is developed attempt to foster cognitive resources. One of these cognitive resources is in-depth knowledge (Bonk & Smith, 1998). The knowledge and nature of a subject inform the selection and application of thinking skills just as these thinking skills affect the knowledge derived (Glaser, 1984). According to cognitive psychology, less successful learners lack, amongst other things, domain-specific knowledge (Bonk & Smith, 1998). It is thus crucial in financial management that learners develop an in-depth knowledge of the subject matter in order to facilitate critical thinking.

In metacognition knowledge is broken up into three distinct types of knowledge: declarative, procedural and conditional. Declarative knowledge is knowing 'that' something is the case (Eide, 2000). Knowing factual information, such as a formula in financial management, would be declarative knowledge (Peirce, 2003). "Procedural knowledge involves 'knowing how' to do things" (Eide, 2000:43). It involves knowledge of how to perform steps in a process. Using the formula mentioned above will reflect procedural knowledge (Peirce, 2003). Declarative and procedural knowledge alone are not sufficient: these two types of knowledge focus only on the knowledge and skills required for a specific task and do not address the conditions under which a certain task will be executed (Eide, 2000). Conditional knowledge is knowledge of knowing "when" and "why" to apply your declarative and procedural knowledge (Eide, 2000). It is also knowledge about when to use a certain procedure, skill or strategy and when not to use it. It entails knowing why a certain procedure works under certain conditions and not under other conditions; it also involves knowledge of why a certain procedure is better than another (Peirce, 2003). Thus knowing when to apply the formula mentioned above would be conditional knowledge. It is evident that conditional knowledge is required for solving ill-structured, practical problems in financial management.

The importance of knowledge in financial management should now be evident. It is, however, valuable to further investigate the relationship or balance between knowledge and skills. Chaffee (1992) describes two basic educational models: the coverage and the critical-thinking model. The first emphasises the covering of

content as opposed to the second, where students not only master information but also develop an understanding of the subject in order to think about and question the information. Chaffee (1992) also states that many teachers are hesitant to adopt a critical-thinking approach, as they are concerned that inadequate time will be available to cover course content. Their reluctance is expected, as they are unfamiliar with, and thus unprepared to adopt, a critical thinking model (Chaffee, 1992).

John Dewey, one of the greatest philosophers and psychologists of education, was also against the mere teaching of knowledge, as he believed that knowledge would soon be outdated. He also believed in the development of thinking and problem-solving skills. Furthermore, he saw the role of a teacher as a fellow learner in the community of learners (Tan, 2007). Dewey (1910) also advocated the importance of understanding the internal mental processes of learners and pointed out the danger of teachers not being involved in research on educational psychology (Tan, 2007). For learners to be effective in the workplace they must be able to solve problems. In order for them to make effective decisions they need to have knowledge – information alone is not enough (Snyder & Snyder, 2008).

Bandy (1994) also emphasised the importance and relevance of problem-solving skills as part of the teaching strategy by stating these skills should be taught even if it means that technical content must be reduced. The importance of teaching problem-solving skills (and other skills) is further underlined by various curriculums changing from ‘content-driven’ to ‘skills-based’ curriculums. The American Institute of Certified Public Accountants Core Competency Framework for entry into the Accounting Profession is an example of an institute which supports this view (Hansen, 2006). The South African Institute of Chartered Accountants (SAICA) also approved the introduction of its competency framework in 2008 (SAICA, 2012).

Candy, Crebert and O’Leary (1994) state that universities include too much technical content at the expense of broader and more general aims, and educationalists further argue that too many students see learning as acquiring facts (information) and memorising them, instead of ensuring they make sense (knowledge). Maher (2000) argues that by concentrating on problem-solving skills as well as the

organisational context of these problems, instead of the facts behind these management accounting methods, one can educate students to become creative problem solvers who can add a lot of value to their organisations (Maher, 2000). As financial management lecturers we tend to focus so much on knowledge (subject content) that we sometimes forget to pay attention also to how knowledge and skills are developed.

It is also valuable to note how information (textbooks etc.) can be used differently in problem-based learning (PBL). The shift in focus from lecturer to student (learning) also implies that students do not merely understand and memorise what is taught: they also need to find relevant information by themselves (Breton 1998). The Open University of the Netherlands, for example, motivates its students to do just that, by providing them with 'too much' literature so that a student cannot read through all the literature. The reasoning is that students must search for information and gain knowledge through selective reading. The problem scenario given to students initiates the process for searching and gaining applicable knowledge. Through this they wish to replicate how problems are solved as well as how knowledge is gained in practice (Van den Brink et al., 2003).

It is essential that students learn to rely on sources other than only their textbooks, before they enter the workplace. Students must also be familiar with when and how to use other sources than their textbooks (Bandy 1994). If students can master this, it then becomes possible to teach them the general structure (contextual framework), leaving the finer details for their own discovery (Breton 1999).

8. KNOWLEDGE AND REGULATION OF LEARNING AND THINKING

Having dealt with problem-solving, learning, thinking and knowledge, we now (further) explore the importance of knowledge and regulation of both learning and thinking. This section dwells more on the vital role of metacognition in learning and thinking.

Metacognition can be conceptualised into a two-factor model (Magno, 2010). The two factors are, firstly, knowledge of cognition, and, secondly, regulation of cognition.

Knowledge of cognition reflects the awareness of individuals' knowledge, learning preferences, styles, strengths and limitations – and also the awareness of how to use their knowledge. Regulation of cognition (metacognition) is the control aspect of learning: it entails the procedural aspect of knowledge which allows effective linking of required actions to complete a specific task (Magno, 2010). As students become more aware of their thinking processes, as they learn, they become more competent in controlling matters such as goals, dispositions and attention (Peirce, 2003). Learners must talk and think about their thinking (McGuinness, 1993). What is crucial in learning is not only the content but also the process of learning (Riding & Powell, 1993). Many ways of thinking happens unconsciously (Riding & Powell, 1993). Metacognition is conceptually closely related to consciousness (Roberts & Erdos, 1993). In other words, thinking needs to be made explicit (Beyer, 2008).

When learners understand how their cognition functions, they develop related knowledge and skills in comprehension, argumentation, reasoning and other higher order thinking skills (Ku & Ho, 2010). Skill learning, such as problem-solving, is effective when the key procedural steps and skill-related knowledge required to carry out the skill is made explicit (Beyer, 2008).

Pedagogy today is all about making learners' thinking visible, as visibility of cognition is a requirement for effective mediation and facilitation. The challenge of education is to develop learning environments in which students' ways of thinking and knowing are founded in active, collaborative, self-regulated and self-directed learning. These pedagogical challenges can be summarised as making content knowledge, teacher thinking and learner thinking visible to learners, peers and teachers (Tan, 2007). Students must self-consciously monitor and regulate their thinking in order to improve performance (Ku & Ho, 2010).

"Self-regulated learning refers to our ability to understand and control our learning environments" (Schraw et al, 2006:111). It can also be seen as a process whereby students participate in diverse strategies to control their cognition, motivation and behaviour (Tan, 2007). Self-regulated learning theory states that learning is governed by various interactive cognitive, metacognitive and motivational components. Cognition reflects skills required to encode, memorise and recall

information, metacognition reflects skills required for understanding and monitoring of cognitive processes and lastly motivation reflects beliefs and attitudes which affects the use and development of cognition and metacognition. The motivational aspect emphasises the importance of students belief in their capacity to learn. Students need to be confident that they can perform a specific task or accomplish a specific goal (Schraw et al, 2006). All three components must be present in order for someone to be a self-regulated learner. Self-regulated learners learn more with less effort and experience higher academic satisfaction (Schraw et al, 2006). A teacher must facilitate the development of self-regulated learning strategies, as this is a vital aspect of metacognition (Tan, 2007).

It is crucial for financial management learners to have knowledge of how their cognition functions, as well as the ability to control their cognition. Financial management teachers should be well aware of these concepts and should guide learners to develop these important skills.

9. PROBLEM-SOLVING INSTRUCTION

This article has thus far attempted to identify and elaborate on some of the important underlying concepts and principles of problem-solving learning. Now that these concepts and principles are clearer, this section will now specifically explore problem-solving instruction.

Problems can be broken up into well- and ill-structured problems. Well-structured problems are clear, and a solution can easily be determined based on the information on hand. An Ill-structured problem lacks a clear problem and solution and may have more than one solution. In the workplace ill-structured problems are the norm, and thus students need to be taught to deal with these types of problems (Chen, 2010). Ill-structured problems consist of vast amounts of data and thus skill in retrieving relevant information becomes vital as well as reasoning skills required for evaluating the evidence against each possibility (Chen, 2010). Bierstaker, Bedard and Biggs (2000) thus argue that in order to enhance critical thinking skills, relatively ill-structured problems and cases should be used in the classroom.

Teachers should be cognisant of the fact that the ‘problems’ they give to students are in many cases ‘exercises’ and not problems, as they include too little novelty. However, this approach may be effective in acquiring fundamental knowledge. To further clarify, in the world we get three kinds of challenges: troubles, puzzles and problems. Troubles are ill-structured problems, while puzzles on the other hand are neat and well structured. A puzzle needs to be placed on a trouble in order to identify the problem. Education should be about teaching students to connect troubles with puzzles to formulate problems. In other words, the only justification for teaching puzzles should be that they relate to troubles (Tan, 2007).

It is extremely important in financial management learning to ensure that learners can ultimately apply their knowledge to troubles. A financial management teacher should also consider the level of cognitive development of the learner and constantly strive to improve this level.

Normand and Baker (2002) and Tan (2007) argue that problem-solving skills can be improved if a generic problem-solving model (strategy), such as the IDEAL model mentioned earlier, is taught before case studies (problems) are given to students. Teachers must then guide students through this five-stage process (Normand & Baker, 2002).

It is important to note that step 2 in the IDEAL model, the problem-defining stage, is the most crucial step in solving a problem. This step must be emphasised during the guided process in order for students to spend more time on building multiple representations of the problem. This stage must also be assessed in order to improve students’ problem-solving performance. By assessing the problem-defining stage rather than a proposed solution, the importance of defining the problem rather than providing the correct answer is also emphasised (Normand & Baker, 2002). The process of arriving at a proposed solution is ultimately more important than the solution itself.

A teacher should model the entire problem-solving process in class, and students then need to internalise these processes as their own problem-solving activities in order to develop self-regulation and metacognitive abilities. If the process of learning

is modelled, students observe, learn and process both problem-solving and thinking skills while acquiring content knowledge (Tan, 2007).

Tan (2007) states that the progressive challenges of a problem-based pedagogy are to make content knowledge visible to learners, to make teachers' thinking visible to learners and lastly to make learners' thinking visible to themselves, their peers (collaboration) and their teacher.

One may argue that educators are all good problem solvers, given their qualifications, positions and practical experience (Anderson & Taylor,1995). While this may be the case, many educators will nonetheless find it difficult to articulate their own problem-solving process, as it comes naturally for them. Most experts develop their professional skills mainly through personal experiences and not explicit training, making the problem-solving process invisible to them (Anderson & Taylor, 1995). In order for educators to make their knowledge available to their students they must articulate their own problem-solving process, even though it might be (indeed, will most likely be) unique. This can be done by asking oneself a few questions regarding one's own problem-solving process. These questions should be based on a generic problem model (such as the IDEAL model). Educators must understand how they solve problems themselves, before they can guide their students to become better problem solvers (Anderson & Taylor, 1994). It is vital that educators solve problems during class in order for students to experience the problem-solving 'process' first hand. Educators must speak to their students, determine what they have done and link these to the steps in the problem-solving process (Anderson & Taylor, 1994).

Chen (2010) argues that problem-solving is mainly taught through two different approaches: constructivist learning and through the use of worked examples (didactics). The first approach is where students construct their knowledge by solving real-world, actual problems. This approach views learning as knowledge construct and not mere absorption. The worked-examples approach allows students to study problem-solving examples rather than solving an equivalent problem on their own. This approach is based on the cognitive load theory and attempts to ease the cognitive demand imposed on students. Research has shown that, for novices,

worked examples are often more effective than solving real-world problems on their own. However, exploration or discovery can be equally effective if students have sufficient domain knowledge (Chen, 2010).

Problem-based learning (PBL) is widely known as a problem-based pedagogy which enhances students' problem-solving ability. Although PBL is not dealt with specifically in this article, it is worthwhile making a few observations on this pedagogical approach. Tan (2007:101) states that: "Problem-based learning (PBL) is an inquiry-based pedagogy that is best rooted in sound understanding of the psychological processes of problem-solving and the development of cognition."

Some further thoughts on PBL will be introduced by comparing it to the traditional case-study method. PBL makes use of problems to motivate, focus and initiate learning. The problem is thus deliberately introduced at the beginning of the learning process to act as a catalyst to acquire knowledge, whereas the traditional case-study method introduces the problem only at the end of a conceptual unit (Hansen, 2006). In other words, the traditional case method is more about practising the application of knowledge previously gained, whereas the PBL method uses the problem as a catalyst to gain knowledge.

It is argued that students exposed to a PBL teaching strategy will potentially gain experiences similar to those they will be experiencing as professionals (Milne & McConnell, 2001). Through PBL students develop problem-solving skills, but also at the same time search and gain the appropriate knowledge. PBL simply uses problems to focus learning (Milne & McConnell, 2001). The principle that appropriate knowledge is searched and gained through solving the problem suggests that the problem is the incentive to acquire knowledge (Breton, 1998). PBL provides a learning experience, which cognitive psychologists suggest is the way people acquire, retain and recall knowledge (Norman & Schmidt, 1992). PBL also provides students with the necessary skills to continue learning in their professional careers (Breton, 1998). The art of knowing how to acquire knowledge in order to solve a problem is also gained through PBL (Milne & McConnell, 2001).

Tan (2007) lists the principles and characteristics of PBL as follows:

- Thinking must be made visible.
- Metacognition and self-regulation is embraced.
- Active learning approach.
- Learner-centred approach.
- Ill-structured, real-world, multi-perspective problems are the starting point.
- It makes use of the problem-solving process (steps).
- Self-directed learning (student accepts responsibility of knowledge and information acquisition) is embraced.
- Collaborative, communicative and cooperative learning is embraced.
- Challenges current knowledge and skills, thus identifying new learning needs.
- Problem-solving skills are as important as knowledge acquisition.
- Guidance by the teacher is crucial (cognitive coaching).
- Motivation to solve the problem is crucial.

It is valuable to see that PBL embraces most, if not all, of the principles behind problem-solving explored in this article. Tan (2007) further stated that an effective PBL pedagogy is mainly characterised by cognition, metacognition and self-regulation.

Lastly, this article briefly discusses the role of assessment as well as self-assessment (self-regulation) in a problem-based pedagogy. The importance of assessing the earlier stages of the problem-solving process has already been discussed earlier in this section.

Assessment techniques can enhance critical thinking, which enables learners to solve problems effectively, when it provides learners with an intellectual challenge which requires and promotes thinking rather than memory recall (Snyder, 2008). It is key for the financial management teacher to ensure assessments are set in an appropriate manner which facilitates problem-solving skill development.

Assessments must also assess students' ability at all levels of the cognitive taxonomy, and assessments should include higher-order skills such as application,

analysis, synthesis and evaluation (McEwen, 1994). Assessments must require higher levels of formal reasoning (refer to Piaget's levels of formal reasoning) if reasoning through and ultimately solving ill-structured problems is the educational goal (Jones & Davidson, 1995).

In a problem-based pedagogy the role of self-assessment is a key component of metacognition: learners use self-assessment to assess their effectiveness in reaching their goal. Learners will then make use of self-regulation in response to their self-assessment (Peirce, 2003).

10. CONCLUSION

Problem-solving is indisputably an important skill required by all financial management learners. The importance of technical content, or, rather, principles in our subject field is not denied, but we cannot focus solely on technical content and hope that our learners will develop the level of problem-solving required to apply their content knowledge in ill-structured problems in practice.

Financial management lecturers are experts in their field, but not necessarily experts in teaching problem-solving skills. Many aspects of what we as lecturers do may well fit into the principles of teaching problem-solving skills. It is crucial, however, that we constantly remain aware of the principles of and new developments in problem-solving teaching in order to continually improve what we do.

When learners struggle in our subject field, a first response may be to expand our teaching of technical content. An awareness of how learners learn, think and apply themselves, however, may lead to a different and more desirable response.

Adopting a problem-based pedagogy may seem daunting and unrealistic. However, an entirely new pedagogy may not be necessary: even small adjustments to what we already do can surely make a difference to our learners becoming effective problem solvers in practice one day.

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