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The Prominence of Teaching and Learning Problem-solving Strategies in Reading and Writing in English First Additional Language Classrooms.

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Abstract

Since 1994, the Department of Education has introduced several curriculum changes and reforms as part of broad-based interventions to improve the country's education (Chisholm 2005:80; Department of Education 2011a:5). With curriculum change, there is a need for accompanying training and support

measures to update teachers on the rationale, methodologies and value-systems embedded in the new curriculum.

Currently, learners are encouraged to take responsibility for their own learning, specifically urging autonomous learning and learner-centeredness in the teaching process. Educational and management processes should therefore consider the learners first, recognise and build on their knowledge and experiences, and respond to their needs (Education White Paper 1, DoE, 1995: 21). This thinking is progressive in the context of shifting understandings about learning processes. However, such practices are highly complex, and there is a need for research to explore how best to advance such practices in classroom contexts.

One of such needs is to be able to think critically, that is, use 'higher order thinking' skills. Higher-order thinking, also termed higher order thinking skills (HOTS), is a notion of education amendment based on learning taxonomies (such as Bloom's taxonomy). This implies that some types of learning require cognitive processing than others require, but also have more overall benefits. It is thus important for learners to develop these skills which include "critical, logical, reflective, metacognitive and creative thinking" (King, Goodson & Rehani, 1998), ensuring that these are activated when individuals come across unfamiliar problems, doubts, questions, or problems which need to be solved. These skills also provide learners with the opportunity to engage with the target language through negotiation and argumentation.

Keywords: Creative training, problem-solving skills, language learning, educational training.

Introduction

Todd and Barr (2016) point out that when people talk about problem-solving, many immediately think about mathematics. However, problem-solving skills are not only a mathematical skill, but also a skill used in every subject and in all aspects of life. Teaching problem solving is a general skill that is invaluable to learners' learning, confidence and independence. While some parents and educators understand the importance of problem solving, only a few stop and think about its value and how to teach it. Problem-solving is often a word, like 'listening' that parents expect and ask their children to do, but often do not give them concrete steps on how to do it. Problem solving is not just common sense. Learners need to be taught how to identify problems, generate ideas for solving the problem, and then learn to courageously try and

solve the problem. When these skills are taught concretely, modelled, and reinforced, children begin to independently tackle problems (Todd & Barr 2016).

Problem-solving, as one of the higher-order thinking skills, allows learners to have a critical eye and therefore think beyond every problem they come across. Problem-solving includes effectively conveying thought or feeling as well as cognitive components. To solve problems, learners must be willing to do so, as well as believe that they can. Motivation and aspects of attitude, such as effort, confidence, anxiety, persistence and knowledge about themselves, are crucial to the problem-solving process (Jonassen & Tessmer, 1996).

Keywords: Creative training, problem-solving skills, language learning, educational training.

According to the NEEDU report (2012: 30), South African teachers generally have poor subject knowledge in language skills and mathematics, a weakness that is perpetuated as teachers are promoted up the line despite not having the necessary competence. This is possibly the underlying problem in the South African school system. Indeed, recently, Basic Education director-general, Mathanzima Mweli, declared, "Creative thinking, problem solving, innovation and collaboration are skills that education systems in the whole world are looking at" (2018, cited by Fengu, 2018).

Defining Problem-Solving Skills

For much of the 20th century, educators have devoted their attention to trying to define and teach problem-solving skills. In the early 1900s, problem solving was viewed as a mechanical, systematic, and often abstract (decontextualized) set of skills, such as those used to solve riddles or mathematical equations. These problems often have correct answers that are based on logical solutions with a single correct answer (convergent reasoning).

Under the influence of cognitive learning theories, problem-solving shifted to represent a complex mental activity consisting of a variety of cognitive skills and actions. Problem solving included higher order thinking skills such as "visualization, association, abstraction, comprehension, manipulation, reasoning, analysis, synthesis, generalization—each needing to be 'managed' and 'coordinated' (Garofalo & Lester, 1985: 169).

Problem-solving is a skill necessary to all grades and areas of education, because it plays an important role for educational success and for success in real life (Bahar & Maker, 2015). Engaging in problem-solving activities facilitates the acquisition of helpful skills like being flexible and creative, thinking and being productive. All these skills are essential in real life. The development of these problem-solving skills must be a steady and ongoing process, which continues until higher education, and therefore learners should be involved in problem-solving skills from the start of their primary education (Reys, Lindquist, Lambdin & Smith, 2014).

Problem-solving skills are important in the career environment, which is highly competitive and demanding. It is only by improving the problem-solving skills of the learners that once they become part of the general public they are capable of improving their lives. Current research emphasises the role of contemporary education as having not only to focus on knowledge transfer, but also on how to use that knowledge (Chen & Cheng, 2009). The teaching of English should not only be about 'knowing' English and its conventions, but about 'using' English.

Educators do not teach problem-solving strategies sufficiently to enable learners to apply such strategies to their diverse subjects or specifically in this study, the use of English. Many learners still depend on their educators' views and opinions during the lesson because they do not view every situation they come across critically; and they also cannot solve any problem they come across because they lack problem-solving skills which should be developed by the educators as part of their teaching methodology. This paper seeks to identify and establish whether teachers instill this essential skill in selected Limpopo schools for effective content and language learning.

Reading and Comprehension

Language, reading, and reading comprehension are dynamic, interdependent areas of literacy development. For example, language proficiency determines reading fluency and comprehension, while reading increases vocabulary knowledge, which, in turn, improves comprehension.

Pretorius and Lephalala (2011: 2) state that "language is the vehicle through which and in which reading is done, but in whatever language children do their schooling, reading needs to be a central school activity;

it needs to be taught well and it needs to be meaningful." Furthermore, reading is said to be a highly complex phenomenon involving many cognitive-linguistic skills and socially embedded knowledge and processes (Pretorius, 2010). It starts in early childhood and stretches right through into adulthood as vocabulary expansion continues throughout an individual's life. The low literacy levels in South Africa have been reported in numerous studies. In addition, research has also revealed poor levels of reading comprehension as part of the literacy crisis in South Africa (Pretorius, 2010).

Role of Theory in the Study: Cognitive Theory
Problem-Solving strategies

The theory consists of problem-solving, reading comprehension and the cognitive process. Comprehension in reading refers to how well students understand the text. "Strategies for improving comprehension include using background knowledge and experience, making connections to personal experiences, other books, and the world, making pictures in your head (visualising), predicting and confirming ideas and events and identifying the most important information based on the purpose for reading (Pape, 2004).

Reading is principally a problem-solving task. Comprehending what is read, like problem-solving, requires effort, planning, self-monitoring, strategy selection, and reflection. As students move through school reading materials, they become more complex, thus more challenging. "Students who approach reading as a problem-solving activity take an active and strategic approach to reading and are meta-cognitively aware of how well they understand what they read" (Pape, 2004).This justifies the need to teach problem-solving - which is the focus of this study.

The Need to Teach Problem Solving

Problem solving is a basic skill needed by today's learners. Guided by recent research in problem solving, changing professional standards, new workplace demands, and recent changes in learning theory, educators and trainers are revising curricula to include integrated learning environments which encourage learners to use higher order thinking skills, and in particular, problem solving skills.

As education has come under criticism from many sectors, educators have looked for ways to reform teaching, learning, and the curriculum. Many have argued that the divorce of content from application has adversely affected our educational system (Hiebert, 1996).

Learners often learn facts and rote procedures with few ties to the context and application of knowledge. Problem solving has become the means to rejoin content and application in a learning environment for basic skills as well as their application in various contexts.

Today there is a strong movement in education to incorporate problem solving as a key component of the curriculum. The need for learners to become successful problem solvers has become a dominant theme in many national standards (AAAS, 1993; NCSS,1997; NCTE, 1996; NCTM, 1989, 1991).

For example, the 1989 Curriculum Standards of the National Council of Teachers of Mathematics (NCTM) states: "Problem solving should be the central focus of the mathematics curriculum. As such, it is a primary goal of all mathematics instruction and an integral part of all mathematical activity. Problem solving is not a distinct topic but a process that should permeate the entire program and provide the context in which concepts and skills can be learned" (National Council of Teachers of Mathematics, 1989). While many learners of all ages lack necessary basic literacy skills as well as higher order thinking skills, today's workplaces often demand high levels of both skill sets. Economic, organizational, and technological forces have changed the nature of most workplaces.

Among these forces are globalization of the marketplace, democratization of workplace decision-making, synchronous production, new technologies, and multiple roles on most jobs (Mikulecky & Kirkley, in press).

In 1991, the U.S. Department of Labor's Secretary's Commission on Achieving Necessary Skills (SCANS) made recommendations on how to educate students to meet future workforce needs. A key element to emerge from the SCANS Report (1991) was that "teaching should be offered in context, and students should learn content while solving realistic problems." Professional training standards are addressing problem-solving skills as well. Medical, engineering, and business schools are revamping their curricula to focus on problem solving as a key component of the professional curriculum (Barrows, 1980; Woods et. al., 1997).

With scientific knowledge doubling every 5.5 years (Nash, 1994), it becomes increasingly important for students to develop higher order thinking skills. This involves basic skills, but also requires learners to use their knowledge in a variety of domains, perform critical analysis, and solve problems. As educators call for more integrated instruction, problem solving often serves as a core curriculum strand that joins together various disciplines.

Even basic problem solving skills are scarce in the work force, as well. The 1993 National

Adult Literacy Survey (NALS) found that more than half of employed adults had difficulty with completing various problem solving tasks—even simple ones.

> Problem-solving is one of the essential skills the students need in order to be successful in the real world, regardless of which language(s) they use there. Engaging in problem-solving activities may be a way to improve the English reading and writing skills South African learners require for the employment market.

General Problem Solving Models of the 1960's

During the 1960s and 70s, researchers developed general problem solving models to explain problem solving processes (Newell & Simon, 1972; Polya, 1957; Bransford & Stein, 1984). The assumption was made that by learning abstract (decontextualized) problem solving skills, one could transfer these skills to any situation (context). One example of this general problem-solving model is Bransford's IDEAL model:

1) Identify the problem

2) Define the problem through thinking about it and sorting out the relevant information
3) Explore solutions through looking at alternatives, brainstorming, and checking out different points of view
4) Act on the strategies

5) Look back and evaluate the effects of your activity

This model is similar to many of the general problem solving models that were common then and that are still used with many general problem-solving courses found in academic and corporate training settings. These are stand-alone courses, which teach problem solving as a "content-free" thinking skill, not integrated with the rest of the curriculum or work environment.

Problem solving also includes attitudinal as well as cognitive components. To solve problems, learners have to want to do so, and they have to believe they can. Motivation and attitudinal aspects such as effort, confidence, anxiety, persistence and knowledge about self are important to the problem solving process (Jonassen and Tessmer, 1996).

Unfortunately, directly teaching a problem solving process doesn't improve actual problem-solving performance, whether you use a model from the 1960's or one like that in Figure 1.

Beginning in the mid-1980's, researchers found that attempts to teach abstract, generalized problem solving skills proved ineffective (DeBono, 1983; Beyer, 1984). They found that mastery of generalized problem solving skills did not differentiate well between good and poor problem solvers. In fact, researchers concluded that knowledge of context was the most critical feature of skill in problem solving. Thus, current research supports problem solving as a situational and context-bound process that depends on the deep structures of knowledge and experience (Palumbo, 1990). When teaching problem solving, authentic problems in realistic contexts are essential. Learners learn to solve these problems, and only after having done so will they be able to see the similarities of strategy across different contexts and then, only with the right kind of support and structure for their thinking.

Principles for Teaching Problem-Solving

This new understanding of problem solving leads to a number of important principles for teaching problem solving. Instructors can apply these principles whether they teach in classroom or computer-based settings. They form the basis of problem-solving instruction in the PLATO system. Here is a summary of these principles:

1) For any "real-world" job or work skill, identify both the declarative and procedural knowledge components. Give each appropriate instructional emphasis.

2) First introduce a problem solving context, then either alternate between teaching declarative and procedural knowledge, or integrate the two.

3) When teaching declarative knowledge, emphasize mental models appropriate to the problem solving to come, by explaining knowledge structures and asking learners to predict what will happen or explain why something happened.
4) Emphasize moderately- and ill-structured problem solving when far transfer is a goal of instruction.

5) Teach problem solving skills in the context in which they will be used. Use *authentic* problems in explanations, practice and assessments, with scenario-based simulations, games and projects. Do not teach problem solving as an independent, abstract, decontextualized skill.

6) Use direct (deductive) teaching strategies for declarative knowledge and well-structured problem solving.

7) Use inductive teaching strategies to encourage synthesis of mental models and for moderately and ill-structured problem solving.

8) Within a problem exercise, help the learners understand (or define) the goal, then help them to break it down into intermediate goals.

9) Use the errors learners make in problem solving as evidence of misconceptions, not just carelessness or random guessing. If possible, determine the probable misconception and correct it.

10) Ask questions and make suggestions about strategy to encourage learners to reflect on the problem solving strategies they use. Do this either before or after the learner takes action. (This is sometimes called *cognitive coaching).*

11) Give practice of similar problem solving strategies across multiple contexts to encourage generalization
12) Ask questions which encourage the learner to encourage the learner to grasp the generalizable part of the skill, across many similar problems in different contexts.

13) Use contexts, problems and teaching styles which will build interest, motivation, confidence, persistence and knowledge about self, and reduce anxiety.

14) Plan a series of lessons which grow in sophistication from novice-level to expert-level understanding of the knowledge structures used.

15) When teaching well-structured problem solving, allow learners to retrieve it (e.g., from a reference card). If the procedure is frequently used, encourage memorization of the procedure and practice until it is automatic.

16) When teaching moderately-structured problem solving, encourage the learners to use their declarative (context) knowledge to invent a strategy which suits the context and the problem. Allow many "right" strategies to reach the solution, and compare them for efficiency and effectiveness.

17) When teaching ill-structured problem solving, encourage the learners to use their declarative (context) knowledge to define the goal (properties of an acceptable solution), then invent a solution. Allow many "right" strategies and solutions, and compare them for efficiency and effectiveness.

Language

It is already clear that language plays a key role in cognitive development. Language aids conceptual development (Section 2b), the development of a theory of mind (2c), episodic memory development (3a) and is the basis of working memory (3b). It also plays a key role in Vygotsky's theory of cognitive development (see Section 9, following). Infants then use the same abilities to acquire the phonological (sound-based) aspects of language that they use to acquire knowledge about the physical and psychological worlds, namely associative learning, tracking statistical dependencies, tracking conditional probabilities and making analogies (see 1a). Word learning is aided by the universal tendency of adults (and children) to talk to babies using a special prosodic register called infant-directed speech (IDS) or 'Motherese'. IDS uses higher pitch and

exaggerated intonation (for example increased duration and stress) to highlight novel information, which appears perceptually effective in facilitating learning (for example Fernald and Mazzie 1991).

Cognitive development

Word learning is also important for cognitive development because it is symbolic. Words are symbols because they *refer* to an object or to an event, but they are not the object or the event itself. Symbols allow children to disconnect themselves from the immediate situation. Gestures are also symbolic (for example waving 'goodbye'). Gesture precedes language production in development, providing a 'cognitive bridge' between comprehension and production (Volterra and Erting 1990). Action is used to express meaning. Even later in cognitive development, gesture can provide important information about what the child understands in a given cognitive domain.

Vygotsky argued that language is the primary symbolic system and that, once acquired, language mediates cognitive development. As speech becomes internalised ('inner speech'), it becomes fundamental in organising the child's cognitive activities. 'Sign systems' or 'psychological tools' such as language, drawing and writing are culturally transmitted, and so the inter-relatedness of social and cognitive processes in children's learning is fundamental. Eventually, sign systems will mediate psychological functioning *within* the child, primarily via inner speech. The importance of learning from others is also highlighted by Vygotsky's notion of the 'zone of proximal development' (ZPD). The ZPD differs between children, and essentially measures how much further a child can go when learning with the support of a teacher.

Vygotsky's recognition that learning can change the child's developmental level suggests that teachers need to discover an individual child's ZPD and teach to that level in order for instruction to bring optimal benefits. Vygotsky also argued that play, in particular the creation of imaginary situations, plays a central role in cognitive development. Joint pretend play requires recognition of the 'rules of the game' and aids the development of self-regulation, as children have to play by the rules. Play in itself creates a zone of proximal development, and while children are highly motivated to play, teachers have an important role in

deliberately creating ZPDs via play in scenarios that support learning (Karpov, 2005).

Russian neo-Vygotskyians (for example Karpov, 2005) have also stressed the role of joint activity with adults for the effective use of the zone of proximal development in teaching.

They argue that verbal mediation is not enough to optimise learning. Shared activity is required to mediate the child's acquisition, mastery and internalisation of new content.

Mediation should begin with the adult explaining and modelling the procedure or material to be learned. The adult should then involve the child in joint performance of this procedure or material, thereby creating the ZPD for the development of a new mental process. The child's mastery and internalisation of the material should then be guided until the adult can begin to withdraw.

Neo-Vygotskyians have also focused on an approach called 'theoretical learning'. This offers an alternative to the constructivist learning pedagogies based on Piaget's theory. Rather than being required to rediscover scientific knowledge for themselves, children taught by theoretical learning are taught precise definitions of scientific concepts. They then master and internalise the procedures related to these concepts by using the conceptual knowledge to solve subject-domain problems (Karpov, 2005). Although claimed by Russian psychologists to be highly effective, Western psychology has not yet studied Vygotsky's ideas about theoretical learning or his ideas about the role of play in education in any detail. Language is crucial for development. The ways in which teachers talk to children can influence learning, memory, understanding and the motivation to learn. There are also enormous individual differences in language skills between children in the early years. Interactions around books are one of the best ways of developing more complex language skills.

Creative thinking can be improved with creativity, and with the use of creative problem solving techniques (Puccio and Murdock, 2001), and open-ended questions (Silver, 1993). Additionally, Meissner (1999) says that students should be asked challenging question to improve creativity in mathematics. It is commonly believed that divergent thinking exercises should be done in the training. A desired teaching situation can be reached through problem solving and brainstorming being used in conjunction with each other, and to encourage the students to produce more answers, the mathematics teacher needs to assume the role leader

for these exercises. Real life questions should be presented to students and problems should include contradictory situations. This gives them an opportunity to use their creative thinking (Ediger, 2000). According to Fisher (1995), real life problems, as they were developed to consider real life, need to be open-ended.

Zone of Proximal Development (ZPD) - How Vygotsky's zone of proximal development applies to problem-solving

Vygotsky (1978) describes the Zone of Proximal Development as "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance with peer collaboration with more capable peers" (Vygotsky, 1978). In other words, a student is able to perform certain tasks better under adult guidance or with peer collaboration than what could be achieved alone (hence its inclusion here – higher order thinking needs to be taught and 'scaffolding' would assist learning thereof). The ZPD bridges the gap between what is known (Zone of Current Development) and what can be known. Vygotsky claimed that learning occurred in the zone of what can be known.

Bruner (1985) relates the term 'scaffolding' to Vygotsky's concept of ZPD. Bruner uses scaffolding as a metaphor for describing the form and quality of the intervention by a 'learned' person in the learning of another person:

> If the child is enabled to advance by being under the tutelage of an adult or a more competent peer, then the tutor or the aiding peer serves the learner as a vicarious form of consciousness until the learner is able to master his own action through his own consciousness and control. When the child achieves that conscious control over a new function or conceptual system, it is then that he is able to use it as a tool.

Up to that point the tutor in effect performs the critical function of 'scaffolding' the learning task to make it possible for the child, in Vygotsky's words, to internalize external knowledge and convert it into a tool for conscious control' (Bruner, 1985: 24-25).

Bourke (2012) provided several arguments supporting the role of problem solving in language learning. Firstly, problem-solving exploits the learners' natural tendency to work things out. Studies in child language acquisition demonstrate that in language learning one cannot proceed very far without attempting to form hypotheses. Secondly, problem-solving promotes what is known in the educational literature as significant learning, i.e. learning which is both self-discovered and meaningful. It enables learners to discover knowledge, internalize it, and subsequently reproduce it. Lastly, problem-solving is an enjoyable activity when success is ultimately achieved. It is a well-established fact that learners learn spontaneously when they are interested and actively engaged in the learning process (Bourke, 2012).

According to the related literature, creativity in problem solving related to thinking patterns such as creative, divergent, reflective and convergent thinking. According to Feldhusen (1995:31), creative thinking is the process of modifying ideas from existing knowledge, along with the ability to form, or to bring forth, a new thought by using intellectual imagination. Divergent thinking develops and broadens our thinking process while thinking divergently entails starting with a specific problem or idea and generating various perspectives on it. The purpose of divergent thinking is to ignore constraints, and to entertain all different kinds of possibilities. On the other hand, there is a parallelism between the uses of divergent and creative thinking together by teachers in mathematics lessons. Haylock (1987, 1997) notes that having an acceptance of teachers receiving improved creativity in problem solving by getting rid of obsessions, and through divergent thinking.

Conclusion

The educational system in terms of the attitudes of teachers towards the students and their educational philosophy may become a barrier for creativity. Especially, at primary school, as education is regarded as students' feedback that has been learnt to the teacher in the same the way it is taught to them. From the 1st to the 8th grade the students have been discouraged from being creative, and from using their imagination. Using this process of educating, the way of thinking for the students will end in them either quitting or forgetting what they were taught (Whitson, 1994: 2). Educational institutions should force individuals to put their ideas into a form, to restrict them, and make them solid. Motivation plays a crucial

role in improving creativity, and there are various ways to improve creativity. In the early stages of problem-solving, one needs to have strong observational skills. Rather than accepting issues at face value, you need to demonstrate lateral thinking and analytical abilities. These will help an individual to properly assess what's going on and pinpoint the core cause of the issue, both socially and academically.

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