Understanding metacognitive awareness among teachers in the school system: issues and benefits

Jolly Okoza[1]
School of Education, National Open University of Nigeria, Lagos, Nigeria

Oyaziwo Aluede[2]
Dept of Guidance and Counselling
Faculty of Education, Ambrose Alli University, Ekpoma-Nigeria
prof.oyaziwoaluede@yahoo.com, oyaziwoaluede@gmail.com

This paper deals with the understanding of metacognitive awareness among teachers. The concept of metacognition is operationalized. This is followed by the essence of metacognition and learning. We move further to examine issues and benefits of metacognition in the school system. To make metacognitive strategies an integral part of the school curriculum, the paper proposes: (1) Specific metacognitive strategies in the classroom, and (2) deliberate school training programmes on metacognitive instruction. The study concludes that both pre-service and in-service teachers should be trained on general awareness of metacognition to enhance learners' academic performance.

Key Words: Higher-Order Cognition; Metacognition, Self- Instruction, Self- regulated Learning, scaffolded instruction,

Introduction

Educational psychologists are promoting the importance of metacognition for nurturing and regulating students' learning. This trend in educational reform is to teach and learn from a constructivist perspective, which is derived from a cognitive approach to children's learning. The constructivist belief is that for too long, in our educational system, children have been required to sit still, be passive learners, and rotely memorize irrelevant and relevant information. Teachers should not attempt to simply pour information into children's minds as if they were receptacles or containers. Rather, children should be encouraged to explore their world, discover knowledge, reflect, and think critically. To achieve this, metacognition, which acts as the 'manager' or 'coach' of a person's learning, should be applied in schools.

According to Anderson (2002), developing metacognitive awareness in learners may lead to the development of stronger cognitive skills and deeper information processing. It also results in critical but healthy reflection. These qualities are not common features among some learners in schools. In their study on students' use of self-regulated learning strategies, Okoza and Imhonde (2010) found that metacognitive strategies were neglected. This gap in the school system may delay teaching and learning.

Insufficient training of teachers is the main factor that may inhibit learners' use of metacognitive strategies. Our recent oral interview conducted with 123 in-service teachers (68 primary and 55 secondary school teachers) in Edo State, Nigeria, revealed that little is known about the role of the teacher as a model in metacognitive strategies; that is, as setting the example for students and providing them with feedback. When the interviewees were interviewed about the concept of metacognition in teaching and learning in the classroom, the participants' responses showed they were novices about the meaning of the concept. A further probe about the application of metacognition in their classrooms revealed a paucity in their knowledge.

Furthermore, our experience in the process of teaching practice supervision of pre-service undergraduate education students and postgraduate diploma in education students in secondary and primary schools in Edo State, Nigeria revealed that the teaching strategy most commonly used was the didactic approach. The didactic teaching method is where the teacher assumes complete control in setting tasks, prescribing procedures and evaluating results. Didactic teaching inhibits children's thinking and reflection as it encourages learners to be passive in the classroom (Fisher 1998). This approach does not favour students' optimal learning and productivity. For effective teaching and successful learning, we need to introduce metacognitive strategies into classrooms. This involves planning, monitoring, evaluating, checking, revising and self-testing (Schneider & Lockl 2002).

Educational psychologists have recommended a number of specific instructional approaches to teaching metacognition. Schraw, Crippen, and Hartley (2006), Paris and Winograd (1990), Darling-Hammond, Austin, Cheung, and Martin (2008) urged teachers to provide instruction in cognitive and metacognitive strategies. Okoza and Imhonde

1. Jolly Okoza Ph. D is a Lecturer in the School of Education, National Open University of Nigeria, Lagos, Nigeria
2. Oyaziwo Aluede Ph. D. is Professor of Guidance and Counselling, Dept of Guidance and Counselling, Faculty of Education, Ambrose Alli University, Ekpoma-Nigeria

(2010) specifically lamented the poor use of self-regulated learning strategies in the classrooms in Nigeria and found that teachers and students in Edo State, Nigeria, often failed to reflect upon and regulate their teaching and learning strategically.

The thrust of this paper, therefore, is to create an understanding of metacognitive strategies in teachers in order to raise teachers' self-awareness in teaching, and train learners to become self-regulated learners. This paper seeks to promote the integration of metacognition into the classrooms in schools and to train teachers on how to teach with metacognitive strategies and train students on how to learn metacognitively. Consequently, this paper is organized in the following ways: meaning of metacognition; metacognition and learning; issues and benefits of metacognition in classrooms; and strategies teachers can adopt to foster metacognition in the school system.

Meaning of metacognition

According to the *Oxford Dictionary of Psychology* (Colman 2003), metacognition refers to knowledge and beliefs about one's own cognitive processes, an important class of metacognition being meta-memory. Writings on metacognition can be traced back to De Anima and the Parva Naturalia of the Greek Philosopher, Aristotle (384-322BC). Fisher (1998) opined that the concept of metacognition can be seen as a turning point in our understanding of the mind. The prefix "meta" has come to refer to something that transcends the subject it is related to – "cognition".

The term "metacognition" was introduced by Flavell in 1976 to refer to the individual's own awareness of and consideration for his or her cognitive processes and strategies. He defined metacognition as follows: "in any kind of cognitive transaction with the human and non-human environment, a variety of information processing activities may go on. Metacognition refers among other things to the active monitoring and consequent regulation and orchestration of these processes in relation to the cognitive object or data on which they bear, usually in the service of some concrete goal or objective" (232). Flavell sees metacognition as that unique human capacity of people to be self-reflective, not just to think and know, but to think about their own thinking and knowing

It is important to note that subsequent development and use of the term have remained relatively faithful to this original meaning by Flavell. Cross and Paris (1988) defined it as the knowledge and control children have over their own thinking and learning activities. Kuhn and Dean (2004) see it as awareness and management of one's own thought. As Kuhn and Dean (2004) explain, metacognition is what enables a student who has been taught a particular strategy in a particular problem context to retrieve and deploy that strategy in a similar but new context.

Further, Schraw (1998) describes metacognition as a multidimensional set of general, rather than domain specific skills. These skills are empirically distinct from general intelligence, and may even help to compensate for deficits in general intelligence and/or prior knowledge on a subject during problem solving. More specifically, metacognition is "an appreciation of what one already knows, together with a correct apprehension of the learning task and what knowledge and skills it requires, combined with the ability to make correct inferences about how to apply one's strategic knowledge to a particular situation, and to do so efficiently and reliably" (Peirce 2003:2). Students who are able to identify suitable learning strategies in the proper situation are using metacognition. For example, if a student may understand that he/she has been taught to use a graphic organizer, such as a concept map to identify main concepts, and link them together using lines similar to a spider web, then that student has used metacognition to complete the task (Nelson & Conner 2008).

Put simply, metacognition is knowing about knowing, and it is most broadly defined as awareness and control of one's cognition (Baker & Brown 1984; Gourgey 2001). As remarked by Garner (1988), and Paris and Winograd (1990), since cognition includes all human mental activities, it is rather difficult to give the notion an operational definition; and researchers emphasize different aspects of it and adopt different terminology to explain the concept. According to Veenman, Van Hout-Walters, and Afflerbach (2006), what most conceptualizations of metacognition have in common is that they take the perspective of "higher-order cognition about cognition". This means that there is a higher-order agent overlooking and governing the cognitive system, while simultaneously being part of it. In reality, metacognition draws on cognition. If metacognition is conceived as knowledge of a set of self-instructions for regulating task performance, then cognition is the vehicle of those self-instructions (Veenman *et al.* 2006).

Furthermore, cognitive strategies are used to help an individual achieve a particular goal (e.g. understanding a text) while metacognitive strategies are used to ensure that the goal has been reached (e.g. quizzing oneself to evaluate one's understanding of that text). Metacognitive experiences usually precede or follow a cognitive activity. They often occur when cognition fails, such as recognition that one did not understand what one had just read. Such an impasse is believed to activate metacognitive processes as the learner attempts to rectify the situation (Roberts & Erdos 1993).

Metacognition and learning

Metacognition allows an individual to control, govern or direct his/her own activity through self-imposed rules and regulations during learning in the classroom and in different circumstances. Learning of students involves self-monitoring and self-control. According to Nelson and Narens (1990, 1994), self-monitoring and self-regulation or control correspond to two different levels of metacognitive process that interact very closely. Self-monitoring refers to keeping track of where one is with one's goal of understanding and remembering (a bottom-up process). In comparison, self-regulation or control refers to central executive activities and includes planning, directing and evaluating one's behaviour (a top-down process) (Schneider & Lockl 2002). These two processes are essential in learning. When a learner applies self-monitoring in learning a task, he or she is engaged in inductive strategies. This involves learning from parts to the whole. In self-regulation, learning is from general to the specifics. These metacognitive elements are veritable processes that enhance students' learning in the school.

When introduced deliberately into the school system, metacognitive strategies will foster students' learning and academic achievement. It should be pointed out that an ordinary person almost never approaches a problem systematically and exhaustively unless specifically educated to do so (Robert & Erdos 1993). Consequently, we must deliberately integrate metacognitive strategies into schools. Students without metacognitive strategies are novice learners who engage in shallow processing of learning materials. Novice learners do not stop to evaluate their comprehension of the material. They generally do not examine the quality of their work or stop to make revisions as they go along (Robert & Erdos 1993). Satisfied with just scratching the surface, novice learners do not attempt to examine a problem in depth (Xiao 2007). They do not make connections or see the relevance of the material in their lives. To correct these anomalies in learners, we need to integrate metacognitive strategies in our school curriculum.

In the last two decades, researchers have attempted to prove that making students metacognitive learners is beneficial not only in general learning but also in specific subject areas such as reading, writing, mathematics, social studies and problem solving. Adey and Shayer (1993) lend strong support to the view that metacognitive elements in thinking exist and can assist the transfer of learning, especially if the teaching explicitly targets metacognition as a key aim of the learning activity. For our students to develop metacognitively in learning, we need to develop in them the qualities of expert learners. Research suggests that experts who study in a wide range of fields have acquired a repertoire of automatic cognitive responses which are not available to novices (Hennessy 1993). In solving complex problems, a novice typically needs to focus on each part of the task; whereas the expert recalls the appropriate technique or thinking frame from past experience, enabling their thinking to be concentrated at a broader and more strategic level. Experts are able to review and process larger chunks of information than novices because their thinking is strategic rather than localized. Experts tend to categorise their knowledge, whereas novices need to focus afresh on each individual task (Fisher 1998).

Metacognition helps children make the most of their mental resources and develop their learning processes through self-reflection. According to Vygotsky (1978), at an early age young children may talk to themselves when encountering difficulties for the purpose of self-guidance and self-direction. The monologues help children reflect on their own behaviour and plan alternative actions (Veenman, VanHout-Wolters & Afflerbach 2006). As children get older, the self-directed monologues will gradually become internalized as silent, inner speech. Later, researchers found abundant evidence to support Vygotsky's assumptions and concluded further that the children who talk to themselves, or monitor themselves in terms of metacognition, when facing challenging tasks tend to outperform those who do not think about their own cognitive behaviour. This cognitive development observed by Vygotsky and other researchers lends strong support to the importance of teaching students how to know about and regulate their cognition to enhance their learning.

Metacognitive development in learners will serve as a veritable means to use monitoring to regulate their study time. This is commonly referred to as the allocation of study time. It shows how learners deploy their attention and effort in learning a task. Brown, Bransford, Ferrara and Campione (1983) posit that the ability to attend selectively to relevant aspects of a problem-solving task is a traditional index of learners' understanding of the task. Developmental studies on the allocation of study time reported an age-related improvement in the efficient allocation of study time (Lockl & Schneider 2004; Masur, McIntyre & Flavell 1973). It is revealed that older children spent more time studying hard items than they spent studying easy items, relative to their younger counterparts. This metacognitive strategy can enhance students' optimal learning in the school. The development of metacognitive skills and strategies in our school system is of paramount importance.

Issues and benefits of metacognition in the classroom

Teachers ought to be knowledgeable in educational psychology where teaching strategic information may have been well learnt. For example, topics such as theories of learning, remembering or forgetting, transfer of learning, memory and motivation and many others should be at the beck and call of content experts (Fordham 2006). The acquisition of skills

and strategies of metacognition as a concept which is being currently advocated by psychologists for teachers in schools may in no small measure transform the teaching/learning process. A quick distinction between skills and strategies is presented. Skills refer to repeated practices or simple directives and connote an automatic, mechanical and consistent cognitive behaviour, while strategies are procedural, purposeful, effortful, willful, essential and facilitative in nature. What distinguishes skill is automaticity and strategy is distinguished by its 'intentionality'. Intentionality presupposes thinking that is deliberate, goal directed and involves planning a sequence of actions (Bormotava 2010).

In fostering metacognition in schools, both veteran teachers and teacher trainees should be well equipped with the nitty-gritty of how to teach metacognitively. Teaching metacognitively involves either teaching with metacognition or teaching for metacognition (Hartman 2001a). The former, i.e. teaching with metacognition, means that teachers know about and think about their own thinking concerning their teaching, whereas the latter means that teachers design instruction that will activate and develop their students' metacognition (Hartman 2001a; Xia 2007). Put simply, teachers must possess both the skills and strategies to teach metacognitively. Metacognition enables teachers to gain awareness about and control over how they think and teach and to monitor, evaluate and regulate their teaching activities in accordance with specific students, goals, contexts, thus exerting great impact on their teaching (Hartman 2001a; Xiao 2007).

On teaching pre-service and in-service teachers, the concept of metacognition and how to teach with and for metacognition in schools, this article discusses some metacognitive approaches. On teaching with metacognition, Hartman (2001b) divides the notion into two types: strategic knowledge and executive management strategies. Strategic knowledge includes knowing "What information/strategies/skills you have, when and why to use them and how to use them", while executive management strategies include "planning, what and how you are going to teach, checking up on or monitoring how the lesson is going as you are teaching, making adjustments as needed, and evaluating how a lesson went after it is finished" (Hartman (2001b:150). In the perspectives of Paris and Winograd's (1990) and Schraw's (2001) taxonomies, strategic knowledge is the teacher's knowledge of cognition, whereas executive management strategies are the teachers' regulation of cognition.

In teaching, both with and for metacognition, Xiao (2007) recommends that teachers need to enhance their own teaching models by knowing strategic metacognitive knowledge about teaching strategies and by self-regulation. Strategic metacognitive knowledge about a teaching strategy includes knowing about what the strategy is, why it is a useful teaching strategy, and how and when it is to be used in a classroom. Veenman (1998) referred to these principles as the WWW and H rule (what to do, when, why and how). For example, a teacher's strategic metacognitive knowledge will include such a strategy that groups of two to four students review and revise their work in a subject period together, i.e. a strategy based upon collaborative learning. Instead of reviewing and revising their work individually on their own, this strategy makes use of collaborative learning that encourages the students in the same group to help each other improve in their work. According to Veenman, Elshow and Busalo (1994), metacognitive instruction from teachers appears to enhance metacognition and learning in a broad range of students; obviously, it is of particular relevance to poor students. The collaborative learning strategy in the classroom, if well utilized by teachers, will lead to learners' optimal achievement.

Researchers recommend the use of collaborative or cooperative learning structures for encouraging the development of metacognitive skills (Cross & Paris 1988; Hennessey 1999; Kramarski & Mevarech 2003; Kuhn & Dean 2004; Martinez 2006; Mcleod 1997; Paris & Winograd 1990, Schraw & Moshman 1995; Schraw *et al*. 2006). This recommendation appears to be based on Piagetian and Vygotskyian models that emphasize the value of social interactions for promoting cognitive development. Piaget portrayed the instructional value to cognitive conflict for hastening growth, purely attained by interacting with another person at a higher developmental stage. Similarly, Vygotsky identified the zone of proximal development (ZPD) as the distance between what an individual can accomplish alone and what he or she can accomplish with the help of a more capable person (either a peer or an adult). The zone of proximal development defines those functions that have not yet matured but are in the process of maturation, functions that will mature tomorrow, but are currently in an embryonic state (Vygotsky 1978).

Students participating in cooperative or collaborative learning expressed their mathematical ideas in writing more competently than those who worked alone (Mevarech 2003). Moreover, as Schraw and Moshman (1995) note, peer interaction can encourage the construction and refinement of metacognitive theories, which are frameworks for integrating cognitive knowledge and cognitive regulation. Kuhn and Dean (2004) argue that social discourse can cause students to "interiorize" processes of providing elaborations and explanations, which have been associated with improved learning. Teachers having knowledge of collaborative instruction is not enough; how it is used and when it should be employed is essential. The teacher must also know that the strategy can effectively assist students in planning actual work and in revising their learning process. Furthermore, he or she should be aware that the strategy can also

lower students' anxiety and teach the importance of audience awareness when students learn from each other (Xiao 2007). Therefore, students should be explicitly taught how to collaborate, a point echoed by Kramarski and Mevarech (2003).

A teacher's metacognitive regulation enables him or her to plan for the instruction and application of strategies in the curriculum, to develop compensatory activities to assist students, and to evaluate the effectiveness of their own teaching and students' learning. According to Xiao (2007), many teachers think about their students, teaching material, activities and objectives before they teach. For instance, novice teachers may spend much and great effort planning for their teaching by writing detailed teaching plans, designing teaching aids and preparing external rewards.

Specific metacognitive instructional strategies for the classroom

Researchers have recommended a number of specific instructional approaches to teaching metacognition. For example, many researchers have noted the importance of providing explicit instruction for both cognitive knowledge and cognitive regulation. Cross and Paris (1988) recommend providing explicit instruction in declarative, procedural and conditional knowledge. Similarly, Schraw, Crippen and Hartley (2006) and Schraw (1998) urge educators to provide explicit instruction in cognitive and metacognitive strategies. Schraw (1998) emphasizes that such strategy training needs to emphasize how to use strategies, when to use them, and why they are beneficial. Several researchers echo the importance of highlighting the value of particular strategies in order to motivate students to use them strategically and independently (Cross & Paris 1988; Kramarski & Mevarech 2003; Schneider & Lockl 2002).

Pressley (1997) argues that when learners are given instruction about effective strategies, they can often apply strategies that they previously have not used on their own. He emphasizes that learners benefit when the teacher models appropriate strategy and overtly verbalizes its steps. Learners subsequently practise the strategy, guided and supported by the teacher's feedback, until they can use it autonomously. When instructing learners about employing a strategy, it is good to explain to them how using the strategy will benefit them. Initially, it takes time to learn to execute the strategies, and it requires guidance and support from the teacher.

Students can be encouraged to develop a sense of their own knowledge by asking questions such as, "What do I know?" "What do I not know?" and What do I need to know?" These types of reflective questions can help students become more self-aware and help them make real-world connections to the information they are currently learning (Peirce 2003). In an effective classroom, teachers are responsible for helping students develop better metacognitive skills by incorporating active reflection throughout the learning. This paper advocates the integration of such practice in schools. To achieve this purpose in schools, pre-service and in-service teachers should be knowledgeable on how to apply the metacognitive strategies of Darling -Hammond *et al*. (2008) in the classroom.

Darling-Hammond *et al*. (2008) listed the following examples of explicit, effective instructional metacognitive strategies that teachers should help students to learn:

1. Predicting outcomes: Help students to understand what kind of information they might need to successfully solve a problem;
2. Evaluating work: Reviewing the work to determine where their strengths and weaknesses lie with their work;
3. Questioning by the teacher. The teacher asks students as they work: "What are you working on now?" Why are you working on it", and "How does it help you?"
4. Self -assessing: Students reflect on their learning and determine how well they have learned something;
5. Self-questioning: Students use questions to check their own knowledge as they are learning;
6. Selecting strategies: Students decide which strategies are useful for a given task;
7. Using directed or selective thinking: Students choose consciously to follow a specific line of thinking;
8. Using discourse: Students discuss ideas with each other and their teacher;
9. Critiquing: students provide feedback to other students and their works in a constructive way; and
10. Revising: Students return their work after receiving feedback .

When these steps are explicitly taught to students by teachers, it will motivate students because it directly affects attribution and self-efficacy. Consequently, this model of metacognitive strategies should be emphasized in schools as it may lead students to achieve good results.

School training programme on metacognitive instruction for schools

Metacognitive instruction needs to be an integral part of the instructional objectives and to be taught over entire school years. The most effective way for teachers to teach their students to become metacognitive learners is probably to allow metacognitive instruction to permeate their curriculum (Xiao 2007). To teach with metacognition, teachers should always

reflect upon and monitor their teaching for all the classes. To teach for metacognition, it is particularly important for teachers to devote the entire school curriculum, not just a single class or unit, to the instruction that gradually guides the students to internalize the metacognitive knowledge and strategies to an automatic state (Fisher 1998). In adopting the explicit and scaffolded strategies, teachers should clearly know that teaching activities that are aimed to develop students' metacognitive models usually take more than one week for a unit to be taught. For example, appropriate scaffolded instruction takes at least five weeks to complete (Hartman 1994; Palincsar & Brown 1984).

For effective development of school training programmes on students' metacognitive strategies in schools, scaffolded instruction is recommended for two main reasons: First, teachers' modelling and step-by-step guidance and support can help lower students' anxiety in learning metacognitive knowledge. Secondly, scaffolded instruction gradually shifts learning responsibility from teacher to learner, and thus facilitates the development of students' metacognitive models and academic learning.

To effectively practise scaffolded instruction in schools, the six basic guidelines identified by Rosenshine and Meister (1992) should be followed by school teachers. These strategies are as follows: (1) Present new cognitive strategies; (2) regulate any difficulties during guided practice; (3) provide varying contexts for students to practise; (4) provide feedback; (5) increase students' responsibility; and (6) provide independent practice.

To commence the scaffolded instruction, the teacher needs to firstly model how to do it to provide the students with complete guidance. The students observe the teacher, an expert model, and do little independent thinking at this point. Furthermore, the teacher provides guided practice in different contexts for the students to practise the strategies modelled in the first step. At this stage, the students attempt to perform the task with the support supplied by the teacher. The support can include the teacher providing additional modelling or thinking aloud, offering hints and feedback, and giving partial solutions. As more guided practice is conducted, the teacher gradually transfers the responsibility to the students by decreasing the amount of support and increasing the students' independent thinking. At this stage, the teacher's role changes from model to facilitator, and the practice changes from teacher's control to students' self-regulation. Finally, when the strategies are internalized, the students are able to perform the task on their own.

Educational psychologists are in agreement on the perseverance of teachers in carrying out school training programme in metacognitive instruction. Teachers who implement metacognitive instruction in their classrooms will need a lot of patience. Teachers must imbibe this attitude to enhance students' motivation in learning the metacognitive instructions. Garner (1988), Hartman (2001a), Paris and Winograd (1990), and Sitko (1998) all advise that metacognitive instruction takes up a great deal of class time, and that sometimes students' progress and improvement are hard to observe. Thus, both teachers and students need much patience and persistence to practise the series of teaching activities to achieve the desired goal. At this point, let us look at practical applications of metacognitive instruction to learners.

Practical application of metacognitive instruction to learners

The goal of this activity is to make learners reflect on strategies that can be useful to solve the problem at hand. Thus this activity helps learners to think of relevant strategies, their purposes and appropriate moments to apply them.

What Teachers Should Do

1. Lists of pre-defined strategies are presented to the learners and they are asked to select those they think may help them to solve current problems. Besides that, learners should be allowed to create their own strategies and also to edit existing ones. Extra functionalities can be incorporated, such as ordering the strategies by importance or relevance, identification of strategies that are always used for all problems, etc. We can achieve this if we carefully adapt what Schraw and Dennision (1994) have recommended in teaching metacognitive instruction. These are:

1.1 Strategies for Monitoring Understanding of Metacognition

- Read the problem more than once.
- Read the problem to separate important parts or identify components.
- Think of a related problem you have already done and use it as a model.
- Before starting to solve the problem, think what you are supposed to learn from it.
- Read the problem and determine which parts you do not understand well.
- Review the basic concepts that are not clear before attacking the problem.
- Set a goal to yourself and plan the steps to reach this goal.

1.2 Strategies for Controlling Errors.

- Stop and review each step to see if you have made a mistake.
- Reread the problem from time to time to check the forgotten important parts.
- Stop and change strategies if you get lost and confused and do not seem to move anywhere.

1.3 Strategies for Revising

- Think about a way of checking to see if your solution is correct.
- Review all you did to make sure you are not forgetting anything.
- Reread the task description and ask yourself if your solution really meets the task goal (Schraw & Dennision 1994).

We perceive strongly that if teachers can meticulously teach learners these methods of applying metacognitive instruction in the classroom in Nigeria and other countries, it may help to enhance learning.

Conclusion

The basic fact that guided this article was that there is dearth of knowledge about metacognitive strategies for use by teachers in schools. Although teachers do not possess a good knowledge of metacognition and metacognitive strategies, they can be trained to do so. Several studies examining the relationship between metacognition and academic achievement showed that students with higher levels of metacognition were more strategic in mind, resulting in better performance than sdisplayed by students with lower metacognition levels.

Successful students have a greater sense of self-efficacy; attribute their success to controllable factors such as effort and strategy use, and perseverance when facing challenging academic tasks. A concerted effort should therefore be made to train pre-service and in-service teachers by promoting a general awareness of metacognition that will aid them in modeling metacognitive strategies during classroom instruction.

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