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Research Paper

Enhancing metacognitive skillfulness of adolescents

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■ **ABSTRACT :** Metacognition refers to one's "thinking about thinking" and is often defined by its accompanying skills such as monitoring and evaluation. Often researchers use metacognition as an overarching umbrella term but cognitive and educational theorists argue as to whether metacognition is a single construct or made up of distinct, differentiable factors. Metacognition has also been acknowledged as an abstract thinking ability known to enhance learning outcomes. The present research has made an attempt to assess the metacognitive skills among the students of the constituent colleges of PAU Ludhiana. The sample included 200 college students, in age range of 17-18 years. Metacognitive Awareness Inventory developed by Schraw and Dennison (1994) was used to measure the metacognitive skillfulness of the selected subjects and subsequently an attempt was made to prepare guidelines for parents and teachers to create a metacognitive environment since early years through daily interventions to strengthen their learning outcomes.

■ **KEY WORDS:** Metacognition, Planning, Evaluation, Debugging

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Metacognition is usually understood as "cognition of cognition". 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).

According to Inhelder and Piaget (1958), children younger than seven years are not able to keep a record of their own problem-solving attempts due to shortcomings in storing a record of their own cognitive activities. Piaget claimed that the egocentrism of young children prevents them from introspection or treating their own thinking as an object.

However, Flavell (1992) related the concept of metacognition to Piaget's developmental stage of formal-operational thinking. Researchers studying Piaget's work have often concluded that young children are not capable of formal operations, which are necessary for abstract thought. At this stage children are capable of hypothetico-deductive reasoning, which requires metacognitive control. Curiously, the advent of this stage coincides with a brief "spike" in the growth of gray matter in the brain as well as measured by neuroscientists.

The reason why metacognition is so important in education is that students are able to understand their own working minds; they have the ability to transform

their mental processes through planning, goal-setting, reflecting, being self-critical, self-monitoring, self-assessing and self-regulating.

One of the main struggles that students face in trying to develop an understanding of metacognition and ways to develop strategies that positively impact them is an overall lack of awareness to their own learning process. Students, even at a rudimentary level, have some basic understanding of their own knowledge and thinking. Meaningful learning takes place only when students' prerequisite knowledge is related to the learning. In other words, students have meaningful learning only if the instructions comply with their competencies and experiences. For teachers, investigating students' prerequisite knowledge first and designing materials and offering instructions based on students' prerequisite knowledge later are important tasks.

National Curriculum Framework (2005) emphasizes that learning is not simply an activity, which can be taught to the learner. The learner learns or rather constructs his knowledge through experiences, therefore, the task of the teacher is to provide rich and authentic problem-solving environment. So that, the learner, while solving the problem may construct his gamut of learning. If a learner is well acquainted with his own concept of knowledge *i.e.* existing knowledge, acquiring knowledge, study habits etc. along with the regulation of his cognitive processes, he can achieve success.

Parents and the family environment influence the behaviour and decisions taken by adolescents. Thus, parents of students at every level may play a very crucial role in enhancing the metacognitive level of their wards by promoting strategies to construct and regulate their knowledge. Thus, the enriched and appropriate school and home environment plays the major role in nurturing and strengthening metacognitive skillfulness in the children. Teachers and parents work a lot in helping children learn but actually they need to focus on making children understand "how to learn?"

Studies, however, showed that, young preschoolers already start to develop some metacognitive awareness (Blote *et al.*, 2004; Demitriou and Efklides, 1990 and Kuhn, 1999). Although, Whitebread *et al.* (2009) found some planning and monitoring activities in playful situations with youngsters as young as 5 years old, it is generally assumed that the development of metacognitive skills in educational contexts commences around the age of 8-10 years (Berk, 2006, Siegler, 1998 and Veenman *et al.*, 2004).

Veenman (2006) argue that it is most likely that metacognitive skills develop alongside metacognitive knowledge during preschool and early-school years at a very basic level and that these skills become more sophisticated and academically oriented when needed in formal educational settings.

Metacognitive learning skills, strategies, and techniques offer possibilities to energize teaching and make learning more engaging in ways that are consistent with evidence from brain and cognitive studies (Grant and Dweck, 2003 and Ramsden *et al.*, 2011).

With this backdrop it becomes pertinent to acknowledge the importance of metacognition in academic excellence and personal adjustment. Also, it seems worthwhile to explore the status of the metacognitive skills of the students for stability and success in their professional and personal life. Consequently, the present study was planned with the following objectives:

– To assess the status of metacognitive skills of the sample adolescents.

– To suggest the strategies in the identified deficient domains to enhance the metacognitive skillfulness of the adolescents.

■ RESEARCH METHODS

The study was conducted in the four constituent colleges of Punjab Agricultural University, Ludhiana. The final sample comprised 200 college going adolescents aged 17 to 19 years (n=200) studying in the second and third year classes of various undergraduate programmes in the constituent colleges of Punjab Agricultural University, Ludhiana. The subjects were proportionately drawn from each class and were equally distributed across both the genders (Males=100 and Females=100). To assess the metacognitive skills of the respondents Metacognitive Awareness Inventory (MAI) designed by Schraw and Dennison (1994) was used.

■ RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Socio personal characteristics:

The selected subjects of the respondents belonged to 17 years and 18 years of age (49% and 51%, respectively). Data revealed that 5.50 per cent subjects had no siblings, whereas 27.50 per cent had one sibling, 36.50 per cent had two siblings and rest 30.50 per cent had three or more siblings. As regards the educational level of the mothers of the respondents, a major proportion of them were either upto 5th or matric (43.50% and 26%, respectively).

However, 14 per cent were illiterate and only 3.50 per cent were graduates and 2 per cent were post-graduates of adolescents with A major proportion of fathers of adolescents were educated upto matric (42.00%) followed by 24 per cent upto +2, 16.50 per cent upto 5th, 9.50 per cent illiterate, 4.50 per cent graduates and only 3.50 per cent post- graduates.

Regarding occupation of the mothers of the respondents, it was interesting to note that majority of the mothers (77.50%), irrespective of male and female respondents were housewives and the percentage was slightly higher in case of mothers of male respondents (82%) as compared to mothers of female respondents (73%). As regards the occupation of the fathers of the respondents, major proportions (58%) of fathers were engaged in business while very small proportion (1%) was non-working. In the case of family type, 63 per cent of adolescents belonged to the nuclear families and rest (37%) belonged to joint families.

Assessment of metacognitive skills among adolescents:

Metacognition is an abstract cognitive ability which encompasses two components, they are, Knowledge of Cognition and Regulation of Cognition. Knowledge of Cognition component is further consists of three sub-components, they are, Declarative Knowledge (*i.e.* knowledge about self and about strategies), Procedural Knowledge (*i.e.* knowledge about how to use strategies) and Conditional Knowledge (*i.e.* knowledge about when and why to use strategies)

Regulation of cognition component is further divided into five sub-components, they are, planning (identification and selection of appropriate strategies and allocation of resources), information management strategies, comprehension monitoring (it refers to one's awareness of comprehension and task performance or the ability to engage in periodic self-testing while learning.), debugging and evaluation (assessing the processes and products of one's learning, and revisiting and revising learning goals).

The data put forth in Table 1 depicts the component-wise distribution of the respondents across various levels

Table 1 : Per cent distribution of adolescents across varying levels of the sub-components of Metacognition (n=200)

Levels of Metacognition (Components and sub-components)	Overall
Component I- Knowledge of Cognition	
Declarative knowledge	f (%)
High (5.34-8.00)	116 (58.00)
Average (2.67-5.34)	76 (38.00)
Low (upto 2.67)	8 (4.00)
Procedural knowledge	
High (2.67-4.00)	143 (71.50)
Average (1.34-2.66)	39 (19.50)
Low (up to 1.33)	18 (9.00)
Conditional knowledge	
High (3.34-5.00)	115 (57.50)
Average (1.67-3.33)	79 (39.50)
Low (upto 1.66)	6 (3.00)
Component II-Regulation of cognition	
Planning	
High (4.67-7.00)	119 (59.50)
Average (2.34-4.66)	59 (29.50)
Low (upto 2.33)	22 (11.00)
Information management strategies	
High (6.67-10.00)	143 (71.50)
Average (3.34-6.66)	49 (24.50)
Low (upto 3.33)	8 (4.00)
Comprehension monitoring	
High (4.67-7.00)	128 (64.00)
Average (2.34-4.66)	57 (28.50)
Low (upto 2.33)	15 (7.50)
Debugging	
High (3.34-5.00)	142 (71.00)
Average (1.67-3.33)	49 (24.50)
Low (upto 1.66)	9 (4.50)
Evaluation	
High (5.00-6.00)	85 (42.50)
Average (3.00-4.00)	87 (43.50)
Low (upto 2)	28 (14.00)
Total	
High (>34.67)	130 (65.00)
Average (17.33-34.66)	68 (34.00)
Low (upto 17.33)	2 (1.00)

of Metacognitive skills. The data reflects that across the three sub-components of the 'Knowledge of Cognition', more than half of the respondents were falling in high level of metacognition (58.00%, 71.50% and 57.50%, respectively). In case of 'conditional knowledge' 39.50 per cent of respondents were falling in the category of 'average level' of metacognitive skills followed by 38.00 per cent in 'declarative knowledge' and 19.50 per cent in 'procedural knowledge' sub-component. Almost, 9.00 per cent respondents showed up in the 'low level' of metacognitive skills in 'procedural knowledge' followed by 4.00 per cent in 'declarative knowledge' and only 3.00 per cent in 'conditional' sub-component.

It is indicated that among these three sub-components, the respondents exhibited better knowledge about the execution of 'procedural skills' and were therefore, more likely to sequence their strategies effectively during studying. The 'declarative knowledge' sub-component was found in between moderate and low level which indicates that respondents' knowledge and beliefs about oneself as a thinker or learner, and what he/she believes about other people's thinking processes was not so good. However, it was found that 'conditional knowledge' indicating their judgment about assessment of their comprehension errors was moderately developed.

This suggests that parents and teachers need to encourage adolescents in low and average category by making the home and classroom environment more conducive for developing high level of metacognitive skills.

With respect to the second component of metacognition that is 'Regulation of Cognition', the respondents performed better in 'information management strategies' and 'debugging' sub-components with majority of subjects (71.50% and 71.00%, respectively) falling under 'high level' of metacognition. It indicates that respondents were good at processing information and use strategies to correct their learning. On the other hand, 14.00 per cent respondents were found in 'evaluation' sub-component of metacognition followed by 11.00 per cent in 'planning', very few in 'information management strategies (4.00%)' and 'debugging (4.50%)' sub-components. The per cent of 'evaluation' subcomponent of metacognition indicates that adolescents have to work on their analyzing skills of their performance after the completion of learning episode.

Therefore, we can infer that among the various sub-components of "Regulation of Cognition" component of metacognition adolescents were weak in the self evaluation and planning aspect. However, the gender differences were found to be statistically non-significant across all the components and sub-components of metacognition.

Strategies for creating metacognitive environment:

A metacognitive environment encourages awareness of thinking. In the creation of a metacognitive environment, teachers monitor and apply their knowledge, deliberately modelling metacognitive behaviour to assist students in becoming aware of their own thinking. Both parents and teachers provide motivation to the adolescent which is essentially needed by them for becoming metacognitive learners.

There are some activities and exercises one can use in and out of the classroom to provide the explicit training that will develop students' reflective and metacognitive skills. People who study metacognition think about it in terms of metacognitive cycle, which at its most basic includes: planning, monitoring and evaluating.

Planning exercises:

In this stage students think ahead to upcoming assignments and identify what tools, skills, knowledge and resources they already have and what they will still need to acquire in order to get the work done. They also set goals for the tasks and develop strategies for achieving those goals. The strategies include:

Role playing :

In terms of helping students understand who they are as learners in various communities, you can provide roles for students to play as they work on mastering elements of course content. This leads to a particular environment that supports the range of roles created and challenges students to respond to the material-and the conversations in the course-in those roles. This can be a useful strategy for in-class discussions, peer review sessions, and written homework, such as blogging, essays, or reports. For example, before students begin an essay or project, talk to them about their role in the assignment (*i.e.* their role as the author). That is, they would benefit from thinking not only about who their audience is, but who they are as they address that audience.

Critical thinking :

Engage the adolescents in critical thinking (e.g. show them how to challenge received opinions, how evaluate sources for their reliability, and how argue both sides of a question).

Pre-planning :

Plan the activities well in advance before actually performing it. This will provide child a vision how to go ahead and in which direction.

Pre-writing :

As you begin a new project (like exam, surprise test, essay etc.), ask students to examine the prompt and write a reflection that does some or identifies the individual pieces, or tasks, that will need to happen for them to successfully complete the project. Furthermore, if you read these pre-writes quickly and respond to their questions for clarification as soon as possible, you can help students identify strategies they might need to reconsider before they begin.

Monitoring exercises:

In the monitoring stage, students check in with you during the course of their work and report how things are going and where they might need to adjust or adopt new strategies. This kind of reflection during a task is often referred as 'reflection-in-action'. These kinds of exercises often lead to the most productive reflection and learning opportunities. It includes:

Collaborative troubleshooting :

Students should help each other, either in a lab or with groups or partners. For example, if students are working in class on drafting introductions, encourage them to discuss with their neighbours whenever they're struggling.

Post peer review follow-up :

After giving students time to read and consider the feedback they receive in a peer review, have them actively engage with that feedback as they plan their revisions. For example, ask them to choose something a peer disliked or disagreed with and respond to it in writing or in direct conversation with their peers. Alternatively, give them opportunity to explain why they plan to follow a peer's particular piece of advice and also explain when they dismissed piece of advice.

Self-reflective comments on drafts :

As students draft papers or other projects, ask them to insert a few comments that do the following:

– identify areas of struggle;
– ask for a specific piece of advice;
– explain why they believe something specific aspect is already working well.

Then, when you respond to their work, you can engage in direct conversation with them via those comments.

Troubleshooting journal :

This type of journal is for making notes at any time when students have a question or hit a "roadblock" in their work. Once they've noted the issue, they can seek help by talking to peers or to the teacher. They should keep an active record of their troubleshooting process, noting what strategies seem successful and what seem less successful.

Evaluating exercises:

Students look back on the work they've done and reflect on the strategies, tools, resources and processes that served them well. They should also think about what didn't work as effectively, what they learned in the process, what they achieved and how they might translate or transfer the experiences, skills and knowledge gained in the learning. These exercises include:

Predicting outcomes :

Most often seen in mathematics or science classes, predicting helps students understand what kinds of information they might need to successfully solve a problem. Prediction also helps students compare their initial thoughts with the final outcomes of a problem.

Questioning :

Questioning is a great method of stimulating thoughts and analyzing one's learning.

Self-assessing :

Students reflect on their learning and determine how well they have learned something or how their skills have developed.

Self-questioning:

Commonly taught for use in reading tasks, but it is also useful in writing and problem-solving of all kinds, students use questions to check their own knowledge as they are learning. When students learn to ask questions while they work, they intentionally direct their thinking and clarify the areas where they need assistance.

Conclusion:

Results revealed that the major proportion of adolescents studying in constituent colleges of PAU had a high level of metacognition. Further, the male students had higher mean scores as compared to their female counterparts, across various components and sub-components of metacognition. But the students with average and poor metacognitive skillfulness are at a disadvantage and are likely to be in certain learning situations. Metacognitive strategies are acknowledged to be essential for the twenty-first century as they enable students to successfully cope with new situations. Therefore, teachers and parents need to capitalize on their talents as well as access a wealth of resources that will create a metacognitive environment which fosters the development of good thinkers who are successful problem-solvers and lifelong learners.

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