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VALIDITY IN MEASUREMENT OF METACOGNITION

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ABSTRACT:

Importance of metacognition in the acquisition and application of learning skills in diverse domains of inquiry have been established through various recent researches (Alexander, Fabricius, Fleming, Zwahr & Brown, 2003). Metacognition is a multidimensional construct but usually focus is given on two principal dimensions i.e. knowledge of cognition where the mechanisms of one's knowing are self -represented and self-regulation of cognition.

KEYWORDS: acquisition and application of learning skills , Metacognition.



INTRODUCTION :

Metacognitive researches have shown that even the youngest children possess some limited amount of metacognitive knowledge (Baker, 1989; Pressley & Schneider, 1997). Efforts should be made by teachers to provide metacognitive teaching to pupils who need it, regardless of their performance level and it should not be reserved only for more advanced pupils (Jacobs & Paris, 1987; Palincsar & Brown, 1984). This is because of the fact that low ability and insufficient knowledge are compensated by metacognitive awareness (Delclos & Harrington, 1999). Although researches have

been providing evidences in favour of the importance of metacognition, those aspects which affect assessment of metacognition are continuously being the object of debate (Mayer, Suengas & Gonzalez, 1995; Marti, 1995). Assessing metacognition helps to improve those aspects where minimum required level is not met, to learn new strategies and skills, to increase confidence in completing certain tasks correctly and to become more effective in doing different tasks. But, according to Pressley & Afflerbach (1995), the metacognitive techniques used for its assessment have some limitations with respect to the theoretical assumptions and procedures involved just like other areas of psychology.

Development of valid measuring instruments and appropriate tasks to measure metacognitive ability are the two major aspects to be focussed on. The task of metacognitive measurement is complex because of the following two main reasons i.e.

- Metacognition is an inner awareness or process, and not an overt behaviour
- There is a lack of conceptualisation of its meaning as a construct which is generally accepted (Georgiades, 2004)

The methods so far as used in measuring and assessing metacognition have different strengths and weaknesses. Even if interviewing is one of the most popular methods in measuring metacognition, it has been found

out from researches that all types of verbal reports are having many constraints and limitations (Miles, Blum, Staats & Dean, 2003). For example, in case of interviewing small children, their answers may not reflect what they know or what they believe but it may reflect what they can or cannot tell to the interviewer.

Most of the techniques based on informations like interviews, questionnaires, recorded entries and thinking aloud have been facing many controversial analyses which raise questions on the reliability of information, the experimenter's influence and also the limited relationship between what the subject 'says' he knows and what he actually 'does'. It is increasingly realised that research relying on self-report or verbally-based experimental methodologies may significantly underestimate the metacognitive and self-regulated performance of young children (Van Hout Wolters, 2000; Whitebread et al., 2008; Winne & Perry, 2000).

There is evidence that some aspects of monitoring and control processes are not available to conscious awareness (Efklides, 2008; Fitzsimmons & Bargh, 2004; Reder, 1996; Siegler, 1996). Researchers have found out that young children have the capability of performing task and making behavioural adaptations effectively but they are unable to report verbally on what they had done (Flavell, Beach & Chinsky, 1966; Piaget, 1977). This provides evidence for the fact that, for identification, assessment and measurement of metacognitive processes particularly in young children with limited verbal abilities the conscious and implicit process in metacognition should get proper recognition.

Veenman (2005) has done an exhaustive review of methodologies used in metacognition. He has an argument that multi-method designs should be developed to investigate metacognitive phenomena and this should include 'online' methods of data collection along with systematic observation and recording of behaviour.

Reviewing the different measurement issues regarding methods for metacognition measurement, an attempt has been made to find out the validity of a questionnaire used for class V students having the following objectives.

OBJECTIVES

- 1) To find out the patterns of score distribution of class V students on the responses to metacognitive questionnaire.
- 2) To find out constituent factors of the construct metacognition as measured by the metacognitive questionnaire prepared for younger students.

RESEARCH QUESTIONS

- 1) To what extent degree of awareness vary across different level of metacognition?
- 2) What are the constituents of metacognition as a construct?

PROCEDURE

To realise the above objectives the data collected on a constructed questionnaire is re-analysed. The questionnaire used in a research study "Effect of Schooling Process on Learning Outcome" (Rath, et.al., 1996) contains 12 open ended questions as per the guidelines of Swanson (1990) and self report method was adopted to collect the data. This cross sectional study included 100 schools, 98 head teachers, 432 teachers and 1882 students from Hissar district of Haryana. Only metacognition score of 1882 students is re-analysed to find out the factors measured by the used questionnaire.

MEASUREMENT TOOL

The items included in this questionnaire are related to learner's awareness about their own cognitive process and transforming the previous knowledge to new situation. The response categories on open ended questions were ranked 1 to 5 according to the degree of metacognitive awareness. A rating of 5 was given to the answer which indicates the students' awareness of the influence of prior knowledge on performance. A rating of 4 reflects less awareness of the influence of prior knowledge on

performance and generally related to a task variable such as time exposure of information. A rating of 3 reflects relativity in memory and 2 relates to the general superiority of adults with little awareness of the student’s domain specific knowledge. Lastly a rating of 1 is related to motivation or none of the above responses. The students who did not answer the question 0 were given. As there are 12 questions, the maximum score becomes 60 and minimum becomes 0. The test-retest reliability (after two weeks) of the questionnaire was .52 and Chronbach Alpha for internal consistency was .79.

FINDINGS AND DISCUSSION

The statistical analysis was executed with the help of SPSS software. To answer the first research question the distribution of the degree of awareness was examined on the basis of three levels classified on the basis of 33 and 66 percentile of total metacognition score. On the basis of percentile the range of score for 0 to 9, 10 to 20 and above 20 are classified as low, average and high level of metacognition respectively.

TABLE- 1
Distribution of Metacognitive Awareness among the Students having Low, Average and High Level of Metacognition

Item No.	Low Score		Average Score		High Score	
	0	5	0	5	0	5
1	324 (17.2)	45 (2.4)	131 (7.0)	139 (7.4)	72 (3.8)	281 (14.9)
2	484 (25.7)	2 (0.1)	231 (12.3)	14 (0.7)	104 (5.5)	82 (4.4)
3	546 (29.0)	1 (0.1)	297 (15.8)	16 (0.9)	152 (8.1)	102 (5.4)
4	427 (22.7)	2 (0.1)	165 (8.8)	27 (1.4)	42 (2.2)	190 (10.1)
5	536 (28.5)	1 (0.1)	231 (12.3)	14 (0.7)	117 (6.2)	122 (6.5)
6	515 (27.4)	2 (0.1)	262 (13.9)	36 (1.9)	112 (6.0)	220 (11.7)
7	603 (32.0)	1 (0.1)	430 (22.8)	2 (0.1)	231 (12.3)	88 (4.7)
8	608 (32.3)	2 (0.1)	434 (23.1)	29 (1.5)	284 (15.1)	136 (7.2)
9	557 (29.6)	0 (0.0)	344 (18.3)	16 (0.9)	157 (8.3)	119 (6.3)
10	586 (31.1)	4 (0.2)	362 (19.2)	37 (2.0)	147 (7.8)	239 (12.7)
11	549 (29.2)	0 (0.0)	334 (17.7)	9 (0.5)	163 (8.7)	102 (5.4)
12	621 (33.0)	0 (0.0)	409 (21.7)	5 (0.3)	243 (12.9)	81 (4.3)

(In the bracket percentage is given)

Here mentioned how you categorised or derived low, average and high score.

Table- 1 represents the low and high metacognitive awareness among low, average and high level of scores obtained through metacognitive questionnaire. Though the awareness is scored on the basis of degree of metacognitive awareness from 0 to 5, data on low and high level of awareness is presented in the table only. The basic purpose was to analyse whether the distribution of scores are question specific or are in accordance with the level of awareness. It is observed that the low awareness is distributed in each question across different level of metacognition but obviously the percentage are

less among students scoring high in metacognitive questionnaire. In case of low level the percentage range from 17.2 per cent to 33 per cent where as it is 7 per cent to 23.1 per cent, and 2.2 per cent to 15.1 per cent in case of average and high level respectively. In contrast high metacognitive awareness is at high level and it varies from 0 to 2.4 per cent, 0.1 per cent to 7.4 per cent, 4.4 per cent to 14.9 per cent in case of low, average and high level of metacognitive awareness respectively. Question wise, students at all the level have less awareness in Q.No 7, 8 and 12 in comparsion to rest of the questions. It seems the questions require more reasoning to answer become more difficult for younger children.

To find out the factors the responses on all the 12 questions were analysed through factor analysis (Principal component analysis). The inter correlation matrix reveals a significant positive correlation among all the 12 questions. It means all the questions have measured the underlying dimensions of metacognition. Only two factors were derived from the principal component analysis as shown in the following graph. The scree plot helps to identify the number of factors can be selected on the basis of the slope. It is found that after two the curve becomes plateau. These two factors have more than one eigenvalue and explain 44.3 per cent of the vairation of metacognition score in cumulation. The first factor having eigenvalue of 4.3 and explain 35.7 per cent of the total variance. More than 50 per cent of the variations are still unexplained which indicates that still there are some more factors which are not covered by the questions included in the metacognitive questionnaire. After the extraction of factors the factor loadings are presented in Table – 2.

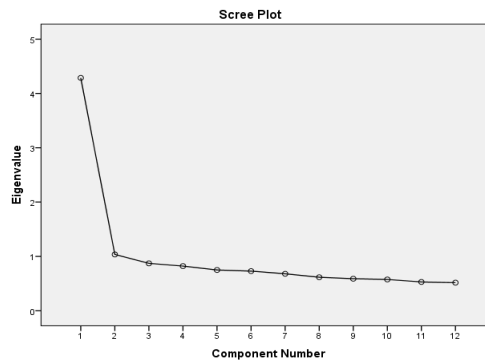


Table - 2
Factor Matrics

Question	Factor 1	Factor 2
m4	.679	.228
m10	.646	-.115
m9	.640	-.168
m7	.635	-.276
m11	.632	-.137
m5	.624	.115
m6	.602	.245
m12	.596	-.253
m2	.579	.345
m3	.571	.100
m8	.526	-.496
m1	.390	.578

From Table 2 it is found the factor loading of factor one ranges from .526 to .679 presented in ascending order and the loadings are for 11 items used in the questionnaire out of 12. Only question no.1 has loading of .578 to factor 2. All the items in the per view of factor one was examined and found that the nature of these questions is related to problem solving. Obviously, while solving a present

problem one has to reflect on the problem solving process used in past. So the first factor derived from factor analysis is awareness of cognitive process. But the second factor loaded on question one (What makes one smart?) only indicates the use of past knowledge only. So the second factor clearly indicates the use of past knowledge on present situation. From the factor analysis results it is observed that the factors which were assumed in the formation of metacognition questionnaire is valid but more loading on awareness of cognitive process but very less on applying past knowledge.

From the recent researches it is increasingly recognised that research relying on self-report as used in the present study may significantly under estimate the metacognitive and self-regulated performance of young children (VanHout Wolters, 2000; Whitebread et. al., 2005; Winne & Perry, 2000). More age-appropriate methodologies have identified and begun to analyse metacognitive and self-regulatory behaviours in much younger children. The recognition of the role of conscious and implicit processes in metacognition has major implications for the identification, assessment and measurement of metacognitive processes, particularly in young children with limited verbal abilities. Veenman (2005), has argued that multi-method designs should be developed to investigate metacognitive phenomena, and these should importantly include the terms “on-line” methods of data collection, including the systematic observation and recording of behaviour. So the tools required for measurement of metacognition may include observation technique in addition to self report on open ended questions to tap the self regulatory behaviour of younger children in addition to awareness of cognitive process.

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