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Interaction Effect Of Metacognition On Achievement In Mathematics Of Secondary School Students With Respect To Gender And Locality

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Abstract

The influence on mathematics achievement are considered as an important aspect of effective learning. The study was conducted on mathematics achievement in relation to metacognitive awareness , gender and locality of residence. The sample consisted of 600 secondary school students both male and female from rural as well as urban school students. Descriptive survey method was used in this study. The data was collected with the help of standardized tools. The findings of the study revealed that there was influence of metacognition on mathematics achievement of students. There was no significant difference in the achievement in mathematics of boys and girls. There was no significant difference in mathematics achievement of rural and urban school students. There was no interaction effect of metacognition and gender on achievement in mathematics among secondary school students and there was no interaction effect of metacognition and locality of residence on achievement in mathematics among secondary school students

Keywords: Metacognition , Mathematics achievement, Gender, Locality of residence.

Introduction

In the modern context mathematics forms the basis of modern science and technological development and thus becomes the subject of national interest. Mathematics is a subject used in every work of life but in our present day school practices, mathematics is presented as an isolated, indifferent and dry subject, which is no more than memorizing formulas, calculations and getting a right answer for a routine problem, mechanically applying a right algorithm. There is no scope for self directive learning and use of metacognitive strategies for improving the ability of students in mathematics. The last decade has witnessed a loud cry from a large number of students who suffer from deep math anxiety and are incapable of solving simple arithmetical problems. A major reason for children doing less well in school mathematics seems to be the way in which the subject is taught in schools, the class room teaching is completely divorced from their everyday experiences knowledge. So there is need is to be realized to explore new strategies to improve learning of mathematics.
Metacogition is a ‘tool of wide application’ and its development gains additional importance and interest because of this fact: As cognition comes into play whenever we operate intellectually in any domain, the same can also apply to metacognition. Thus, although metacognition can be construed as domain specific knowledge, it should be remembered that its 'domain' spans all others, This very advantage allows the metacognitive processes to have a wide application in a range of different situations. It is important, for example, that basic strategies can apply in the metacognitive development of students regardless of grade level or subject area. It is also important that such processes allow the learners to go far beyond the subject of instruction and apply their learning in other, similar situations. Teachers may not maximize their students' potential if they tend to teach them only facts, rules or principles, without teaching them how they can learn more about these or about another content. Similarly, teaching is of little value if it simply asks children to learn by heart some rules, without enabling them to reach conclusions themselves and without helping them to transfer rules in real situations, through problem solving. Such ‘teaching' and ‘learning’ is, at best, limited, and had no breadth, since it does not help children become independent learners, but links such learning to the particular situation in which it occurred and nothing more. On the other hand, expert thinkers are distinguished by the degree to which they strategically plan, manage their time and resources, and monitor their progress during intellectually demanding tasks. They demonstrate metacognitive abilities, i.e, they think about, and direct their own thinking. In this way, metacognitive learning strategies, by aiming to foster abilities such as self-awareness, self-control and self monitoring, produce independent learners who control their own learning and learn how to learn for life
Mathematics in the real sense is a science of space and quantity and helps us in solving the problems of life needing numeration and calculations. It provides opportunity for the intellectual gymnastic of the man’s inherent powers. Mathematics is such a subject which is so valuable and psychologically based and so closely connected with out daily life, is justified to be included in the school curriculum and its teaching should be made compulsory up to high school stage. High and senior secondary education will remain incomplete and will not be comprehensive if mathematics is excluded

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Achievement is the status of the level of a person's learning and his ability to apply what he has learned. 'Therefore there is much importance of the role of affective factors like attitude in learning and teaching mathematics'(Leader and Forgasz, 2006). 'For the proper development of mathematics education, the attitude of students towards mathematics and achievement in mathematics must be taken into account'(Kumar & Singh, 2011). Metacognition has the potential to increase the meaningfulness of student's classroom learning. 'The more students are aware of their thinking processes as they learn more. Students become more aware of their thinking as well as more knowledgeable about cognition in general'(Vijayakumari & D'Souja, 2014). Hence, 'metacognition plays a central role in the learning process, which ultimately affects the student's academic performance at school generally and their mathematical performance specifically'(Panaoura & Philippou, 2005). For the successful solution of any complex problem-solving task, a variety of metacognitive processes is necessary. A metacognitive approach to education explore the knowledge and lay an immense effect on the thinking process of both teacher and the learner in creating a suitable teaching and learning environment. 'Planning the way to approach a learning task, monitoring, comprehension and evaluating the progress towards the completion of a task, these skills are metacognitive. Students can be trained to improve mathematical performance through metacognitive skills such as monitoring or regulation' (Sahin & Kendir, 2013).

Review of Related Literature

Veenman, et al. (2005) studied the relation between Intellectual and Met cognitive Skill in early Adolescence. The results showed that without hits metacognitive skillfulness is the main predictor of initial learning, while intelligence additionally enters the regression equation after the presentation of metacognitive hints. GPA also appears to be predicted by a combination of intellectual and meta – cognitive skills.

Baskaran (2006) conducted a study on effect of metacognition and motivational intervention strategies on developing competencies in teaching science among DIET trainees. It was an experimental study. Single group pretest posttest experimental design was used for it. The present study was carried out in DIET of Pondicherry with nearly 200 students. It was found that competency in teaching science was enhanced in the progressive in post test and the level of metacognition among students teacher was increased. There is a correlation between the metacognition and motivation scores in all pre test and post test. The level of metacognition of students and teachers is increased in the post test than pre test.

Chellamani (2007) conducted a study on metacognitive orientation on enhancing writing competence. This study investigated that metacognitive strategies accounted for the variation in writing competence among students. The self learning strategy allowed students to be alert and got interest in participating in the learning activities of the classroom. Metacognitive articulation developed taste for writing and attempting questions in other genres (Prose and comprehension). The investigator also designed thinking strategies which helped students to draw conclusions, derive influence and make generalization.

Fathima (2008) conducted a study on effect of metacognitive intervention strategies in enhancing teaching competency of B.Ed. students. In this study Single group pre-assessment, Post- assessment design was followed. The findings reveals that it is possible to increase the pedagogical components of teaching competency by making use of the corresponding elements of metacognitive intervention strategies such as clarifying the information, familiarizing the content appropriate learning activities and giving guided practice etc. These are brought out by match setting and instruction. Mind mapping, visual perception, cognitive articulation and registering and retrieving process of brain 52 compatibility. Key questions help to articulate the professional ethics. To increase the organization dimension of teaching competency, there is need of activation of matching of embedded facts and beliefs under brain compatibility and it is possible by the use of metacognitive intervention strategies.

Papinczak et al. (2008) had studied the effects of a Metacognitive intervention on students' approaches to learning and self – efficacy in a first year Medical course. Participants were first-year medical students (N = 213). A pre-test, post-test design was implemented with intervention. Students were experiencing a program of metacognitive activities within their PBL tutorials for at least 20 weeks duration.. It was found that Self-efficacy was significantly reduced for both control and intervention cohorts at the conclusion of the study. A significant reduction in the adoption of deep and strategic learning approach, matched by a corresponding increase in the use of surface learning, was demonstrated for both cohorts. There was a statistically significant association between high self-efficacy and deep learning approach, with older students over-represented in the group of efficacious deep learners. Over the course of first-year medical studies, students lose self-efficacy and move away from deep-strategic learning approaches towards more surface approaches. The program of metacognitive activities failed to reverse this trend.

Vrugi et al. (2008) had conducted a research on metacognition, achievement goals, study strategies and academic achievements: pathway to achievements. The results showed that effective self- regulated learning involved two pathways: a metacognitive and a strategy pathway. The first pathway involved a positive relationship of mastery goals and a negative

relationship of performance avoidance goals with metacognition. Metacognition positively affected the use of the study strategies. The strategy pathway involved positive effect o mastery and performance approach goals on the use of metacognitive and deep cognitive strategies. The use of metacognitive and resource management strategies had a positive and the use of surface cognitive strategies had a negative effect on exam scores.

Objectives

1) To study the Influence of metacognition and Gender on achievement in mathematics of secondary school students.
2) To study the interaction effect of metacognition and Gender on achievement in mathematics of secondary school students.
3) To study the Influence of metacognition and locality of residence on achievement in mathematics of secondary school students.
4) To study the interaction effect of metacognition and locality of residence on achievement in mathematics of secondary school students.

Hypothesis

The following null hypothesis were formulated-

1) There is no Influence of metacognition and Gender on achievement in mathematics of secondary school students.
2) There is no interaction effect of metacognition and Gender on achievement in mathematics of secondary school students.
3) There is no Influence of metacognition and locality of residence on achievement in mathematics of secondary school students.
4) There is no interaction effect of metacognition and locality of residence on achievement in mathematics of secondary school students.

Methodology

Design of the study

Descriptive survey method of investigation was employed in this study. Variables in this study are achievement in mathematics and metacognitive awareness. The survey research is one of the most important areas of measurement in applied social research.

Sample

Total sample of 600 secondary school students, both boys and girls from rural and urban area were randomly selected.

Research tool used

Achievement in Mathematics scale by Singh & Kumar (2009) was used to assess the achievement in mathematics. Metacognitive Awareness Inventory (MAI) by Schraw & Dennison(1994) was used to measure the metacognitive awareness.

Data Collection Procedure

Both the scales Achievement in Mathematics scale and Metacognitive Awareness Inventory (MAI) was administered on all the 600 students. Data was collected and answer sheets were retrieved from the students.

Analysis and Interpretation of data

Table No.-1 Influence and Interaction effect of Metacognition and Gender on Achievement in Mathematics

Source	Sum of Squares	df	Mean Square	F	*p*-value
Metacognition (MC)	455.37	2	227.68	3.121	.045*
Gender	198.10	1	198.10	2.715	.100
MC * Gender	20.19	2	10.10	.138	.871

- Significant at .05 level of significance

Figure- 1 : Interaction effect of Metacognition and Gender on Achievement in Mathematics

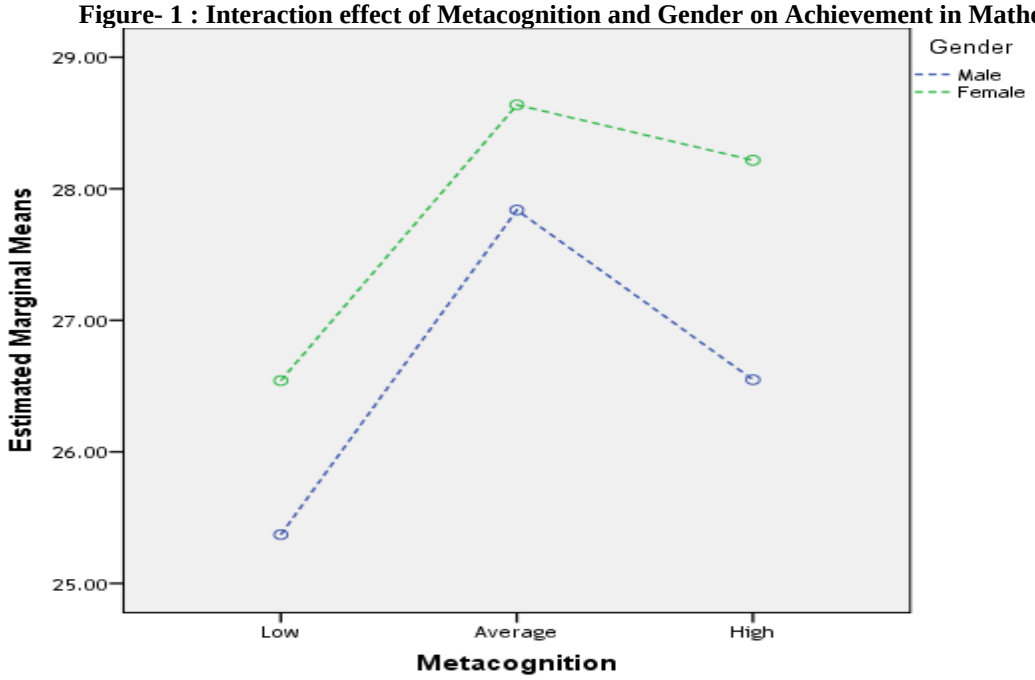

Table no. 1 deals with the influence and interaction effect of metacognition and gender on achievement in mathematics of IX class students.

Effect of Metacognition: It was found that there was a significant difference in the achievement in mathematics with respect to metacognition level. The F- value was 3.121 with *p*- value= .045 which was significant at .05 level. It is concluded that students with different level of metacognition differ significantly on the variable of achievement in mathematics. Therefore it is analyzed that there was the influence of metacognition on achievement in mathematics.

Effect of Gender: There was no significant difference in the achievement in mathematics with respect to gender, as F- value was found to be 2.715 with *p*- value= 0.10 which was not significant at .05 level of significance. It is depicted that boys and girls did not differ significantly from each other on the variables of achievement in mathematics. Thus it is concluded that there was no influence of gender on the achievement of students in mathematics.

Interaction effect of Metacognition and Gender: There was no significant difference in the achievement in mathematics with respect to the interaction effect of metacognition and gender. F- value was found to be .138 with *p*- value= .871 which was not significant at .05 level of significance. Thus, based on the above results, hypothesis 'There will be no interaction effect of metacognition and gender on achievement in mathematics among students' stands accepted. Therefore it is concluded that there was no interaction effect of metacognition and gender on achievement in mathematics among secondary school students.

Influence & Interaction effect of Metacognition and Locality of Residence on Achievement in Mathematics :

Table No.- 2 Influence & Interaction effect of Metacognition and Locality of Residence on Achievement in Mathematics

Source	Sum of Squares	df	Mean Square	F	*p*-value
Metacognition (MC)	574.51	2	287.25	3.968	.019*
LOR	474.84	1	474.84	6.560	.011*
MC * LOR	118.78	2	59.39	.820	.441

- Significant at .05 level of significance

Fig-2: Interaction effect of Metacognition and Locality of Residence on Achievement in Mathematics

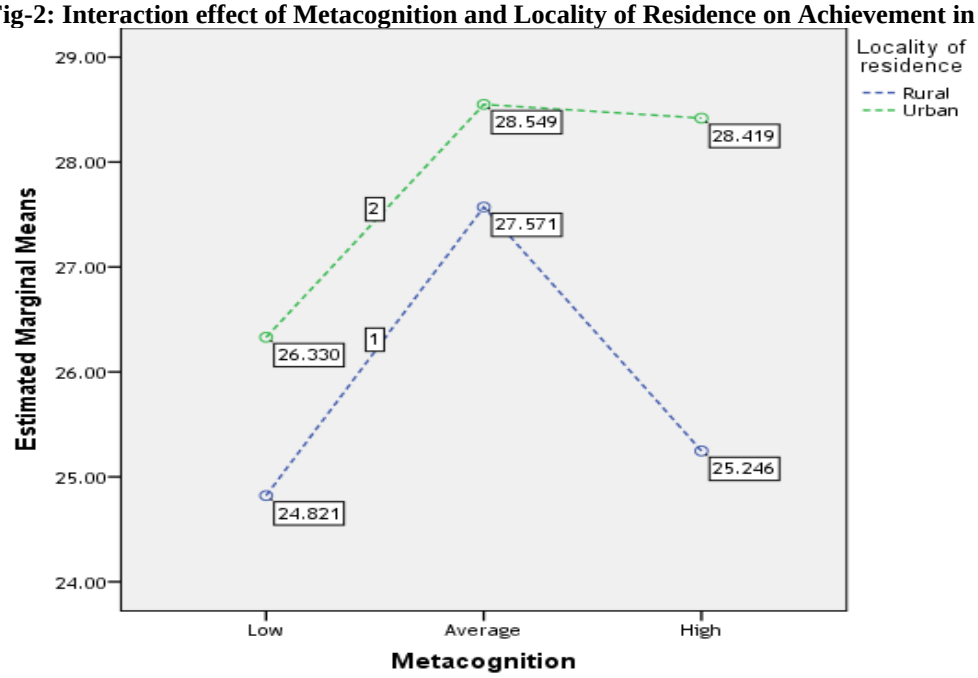

Table no.- 2 deals with the influence and interaction effect of metacognition and locality of residence on achievement in mathematics of IX class students.

Effect of Metacognition: It was observed that there was a significant difference in the achievement in mathematics with respect to their level of metacognition. The F- value was found to be 3.968 with *p*-value = .019 which was significant at .05 level of significance. It reveals that students with a high, average and low level of metacognition significantly affected the achievement in mathematics. Thus it can be concluded that there was an influence of different metacognition level on achievement in mathematics.

Effect of Locality of residence: Significant difference was found in the achievement in mathematics of students with respect to the locality of residence, as F- value was found to be 6.56 with *p*- value=.011 which was significant at .05 level of significance. It depicts that students from rural and urban areas differed significantly from each other on the variables of achievement in mathematics. Thus it is inferred that there was an influence of locality of residence on the achievement in mathematics of secondary school students.

Interaction effect of Metacognition and Locality of residence: There was no significant difference in the achievement in mathematics with respect to the interaction effect of metacognition and locality of residence. F- value was found to be .820 with *p*-value = .441 which was not significant at .05 level of significance. Thus, based on the above results, hypothesis $H_{03(ii)}$'There will be no interaction effect of metacognition and locality of residence on achievement in mathematics among students' stands accepted. Therefore it is concluded that there was no significant interaction effect of metacognition and locality of residence on achievement in mathematics among IX class students.

Conclusions

Findings indicated that there was significant influence of metacognitive awareness on mathematics achievement of secondary school students which means metacognitive awareness play significant role in improving the mathematics achievement of secondary school students. No significant difference in mathematics achievement of boys and girls was found. There was no significant difference in mathematics achievement of rural and urban school students. There was no interaction effect of metacognition and gender on achievement in mathematics among secondary school students and there was no interaction effect of metacognition and locality of residence on achievement in mathematics among secondary school students Hence, an educational course is recommended in order to strengthen metacognitive strategies. Besides, different activities like seminars, workshops should be organized in schools which can further enhance metacognition level of students.

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