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Metacognition among Senior Secondary School Students and its Relationship with Problem Solving Ability

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Abstract:

The act of thinking about thinking is known as meta-cognition. Meta-cognition is the process of reflecting on one's own cognitive abilities, such as remembering, learning monitoring, and study techniques. Metacognitive knowledge is awareness of one's own cognitive functions and knowledge of how to control those functions to enhance learning. Problem-solving ability is a mental process that is the conducting part of the larger problem process that includes problem finding, shaping, and reaching towards a final goal. The aim of this study was to investigate the metacognition of senior secondary school students in relation to socio-demographic variables (Gender and locality) and to examine relationship between metacognition and problem-solving ability of students 600 senior secondary school students that made up the sample were selected using stratified random selection. The tools measuring metacognition and problem-solving ability was used to get the data. The data was analysed through SPSS 20. Mean, S.D. and C.R. value was calculated Further Karl Pearson coefficient of correlation between metacognition and problem-solving ability of senior secondary school students was calculated. The result found that there was significant difference between the metacognition of male and female students, further locality had a significant influence on student's metacognition. It was found that metacognition and problem-solving ability were significantly correlated.

Keywords-Metacognition, Relationship, Problem Solving Ability,

Introduction

Simply said, "thinking about thinking" is the definition of metacognition. Metacognition is the understanding that humans have of their own mental processes. Since the middle of the 1970s, the word "metacognition" has been used in psychology. The phrase is most frequently linked to John Flavell, who formally used it in the title of his article in 1976. Metacognition is essentially the awareness of and deliberate attention to one's own cognitive processes. We do, in fact, engage in metacognitive processes every day.

Ann Brown (1978), a pioneer in the field of metacognition, proposed knowledge of cognition (what we know about our cognition) and regulation of cognition (how we control or regulate our cognition to perform an action) as the two fundamental principles of metacognition that are crucial for learning. Declarative (knowing "about" things), procedural (knowing "how" to accomplish things), and conditional (the "why" and "when" aspects of cognition) knowledge are the three components that make up knowledge of cognition. Planning, regulation, and evaluation are all aspects of cognition regulation. Knowledge of cognition enables people to more efficiently allocate resources and employ strategies, whereas cognition regulation is linked to more systematic abilities such as planning, monitoring, and assessment (Schraw, G., 1998).

Schraw and Dennison (1994) described cognitive regulation as the five parts of planning, information management techniques, understanding monitoring, debugging strategies, and evaluation. Prior to learning, planning refers to goal setting and allocating resources; information management strategies refer to the skills and strategy sequences used to process information more efficiently, such as organizing, elaborating, summarizing, and selective focusing; monitoring refers to the assessment of one's learning, comprehension, and strategy used; debugging strategies refer to the strategies used to correct comprehension and performance errors; and evaluation refers to the strategies used to evaluate one's learning, comprehension, and strategy used. Individuals that are highly metacognitive thrive at planning, managing information, monitoring, debugging, and evaluating.

The ability to think about, understand, and manage one's learning is referred to as metacognition. Metacognition is the ability to monitor and regulate

one's own cognitive processes, as well as knowledge about learning and oneself as a learner. Learners with metacognitive awareness are individuals who are aware of what they know, what they understand, what they don't know, what they don't understand, and why they don't understand. Metacognitive awareness enables learners to reflect on their own cognition processes in order to examine, monitor, assess, and regulate their own thought processes that occur during learning.

Problem solving ability

The term problem solving is considered as a mental activity in which a person finds, examines and tackles problems. This includes every one of the means in the problem process, including the disclosure of the problem, the choice to handle the problem, understanding the problems, investigating the accessible choices and making moves to accomplish the objectives.

Problem solving is the most significant level of learning in the hierarchy proposed by Gagne which relies upon the supremacy of next lower kinds of learning. It includes the use of standards and principles to clarify, deal and address new situations or predict results from known conditions. In problem solving involves forecast, investigation of facts and standards to develop reason and impact relationship of the situation.

Problem-solving requires not only knowledge and cognitive skills but also metacognitive skills, when and how to use knowledge and cognitive resources (Mayer, 1998). Cognitive skills assist in understanding the task and using strategies for solution, whereas metacognitive skills help to regulate the problem-solving process and make decisions (Goos, et al., 2000).

Steps of PSA: Bransford and Stein (1984) advocated five steps that are basically associated with the task of problem solving. These are -Identifying the problem, Defining and representing the problem, Exploring possible strategies, Acting on the strategies, and Looking back and evaluating the effect of one's activities.

Literature review- Dyah Utami et.al(2023), Examined the relationship between scientific students' metacognitive and problem-solving abilities. 32 students from Indonesia's department of science education made up the sample. The conclusion

is that among scientific students, metacognitive and problem-solving abilities are correlated.

Pınar Güner & Hatice Nur Erba (2022), investigated the metacognitive strategies that middle school students used in the process of solving problems individually. The study found that students with high metacognitive skills tend to solve the problem correctly by using appropriate strategies, mathematical notations and logical reasons. Abdelrahman RM.(2020), investigated the relationship and impact of metacognitive awareness and academic motivation on student's academic achievement. According to metacognitive knowledge, women performed better than men on both of the dimensions of metacognitive awareness. Jitendra Kumar (2014), studied metacognition and problem solving ability as interrelated variable and there was found a positive correlation between metacognition and problem solving ability. The findings of the study revealed significant difference among male and female students regarding metacognition abilities.

Objectives

1. To compare the Metacognition of Male and Female Senior Secondary School Students.
2. To compare the Metacognition of Rural and Urban Senior Secondary School Students.
3. To find out the relationship between metacognition and problem solving ability of Senior Secondary School Students.

Hypothesis

1. There is no significant difference between metacognition of Male and Female senior secondary school students.
2. There is no significant difference between metacognition of Rural and Urban senior secondary school students.
3. There is no significant relationship between metacognition and problem solving ability of senior secondary school students.

DELIMITATION

Present study will be confined to the Senior Secondary Students of Bareilly district only.

RESEARCH METHODOLOGY

In the present investigation Descriptive Survey Method was used to find out the metacognition and problem solving ability of senior secondary school students.

POPULATION: All students of senior secondary schools of District Bareilly was the population of the present study.

SAMPLING: In this study simple random and simple random stratified sampling techniques were used.

SAMPLE SIZE: The sample of the study was 600 senior secondary school students. Out of which 150 Male and 150 female students from Urban area and 150 male and 150 Female students from Rural area of Bareilly district were taken.

Tool and techniques: The researcher has used only two tool for data collection

1. Meta Cognition Inventory (MCI) developed by Punita Govil (2003).
2. Problem Solving Ability Test (PSAT) developed by L.N. Dubey

STATISTICAL TECHNIQUES:

In order to study the nature of the data descriptive statistics, mean and standard deviations were calculated with the help of SPSS.20 and t-test was used to find out the significant difference of metacognition between the mean scores of male and female ,rural and urban school students.Besides, karl pearson coefficient of correlation was used for investigate the relationship between metacognition and problem solving ability of senior secondary school students.The mean score of Meta cognition with respect to gender and locality were presented pictorially in the form of graph. On the basis of these tools, procedures and statistical techniques employed, Further the analysis of data, interpretation and discussion have been presented.

DATA ANALYSIS , INTERPRETATION AND DISCUSSION

The data analysis interpretation and discussion were made hypothesis wise

Objective no-1 To study the difference between metacognition of Male and Female senior secondary school students .

1-Analysis -

According to Ho1 “there is no significant difference between the metacognition of male and female senior secondary school students.”

For the verification of above hypothesis the researcher administered a metacognitive inventory on 600 male and female senior secondary school students. Data is analysed and tabulated as follow:

Table No.1

Mean, S.D. and Critical Ratio (C. R.) of Male and Female Senior Secondary School Students on metacognitive inventory

Gender	N	M	S.D	C.R	Df	P	Result
Male	300	86.93	11.28	4.04	598	0	Significant
Female	300	90.49	10.20				

Level of significance at $.05 = 1.96$
 $.05 > P$

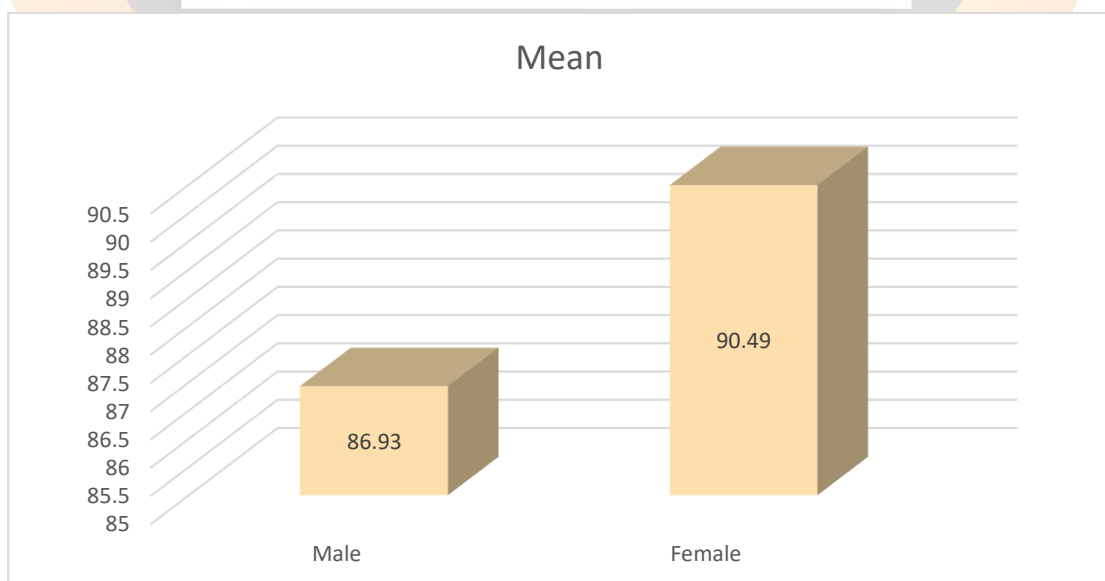


Figure-1

A Bar diagram displaying the difference between Metacognition of Male and Female Senior Secondary School Students

Analysis of the result

As it is shown in table no.2. that the mean of metacognition of male students is 86.93 and female students for the same variable is 90.49 .The S.D. values are 11.28 and 10.20 for male and female students, respectively. The calculated t-test value is 4.04 with the degree of freedom 598.The obtained P value is 0.

Interpretation of the result

As it is obvious from the above table that the mean scores of male and female students are significantly different the C.R.value 4.04 is more than tabulated value at 0.05 level, which is supported by P value that is less than from 0.05. Therefore the null hypothesis “There is no significant difference between the metacognition of male and female students” is rejected because the C.R. value is considerable at 0.05 level. Hence it can be generalized that female students possess higher level of metacognition than male students.

DISCUSSION

From the above interpretation it is shown that there are gender differences in metacognition. There are some researches which support my findings such as Topce & Yilmaz-Tuzun (2009), revealed in their study that metacognition knowledge and regulation are differently associated to gender . It means that male and female students applied their metacognition knowledge and skill in the learning process in different manners. **Weinert & Kluwe(1987)**, found that different academic motivation, perceptions of performances, problem solving process ,planning, thinking skill, Knowledge of how to use thinking and strategies, knowledge of how much one can learn, and what type of strategies to use, causes gender differences in metacognition

Objective no.2 - To study the difference between metacognition of Rural and Urban senior secondary school students .

2. Analysis.

According to Ho2 “There is no significant difference between the metacognition of rural and urban senior secondary school students”.

For the verification of above hypothesis the researcher administered a metacognitive inventory on 300 urban and 300 rural senior secondary school students. Data is analysed and tabulated as follow:

Table No.2

Mean, S.D. and Critical Ratio (C. R.) of Rural and Urban Senior Secondary School Students on metacognition inventory

Locality	N	M	S.D	C.R.	Df	Sign	Result
Rural	300	86.33	10.71	5.47	598	0	Significant
Urban	300	91.09	10.56				

Level of significance at .05= 1.96
.05>P

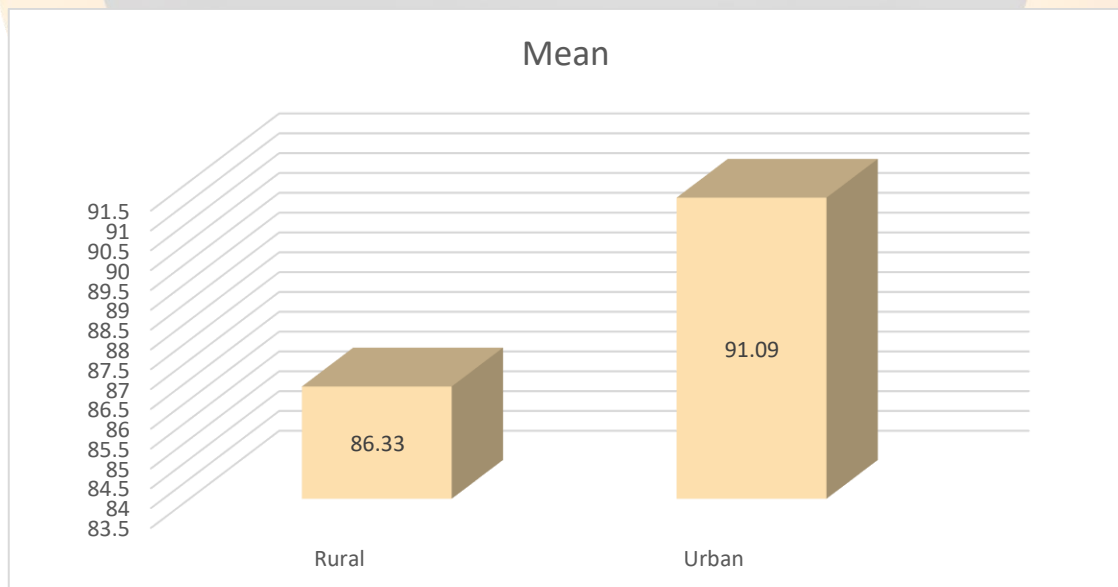


Figure-2

A Bar diagram displaying the difference between Metacognition of Rural and Urban Senior Secondary School Students

Analysis of the result

It is obvious from the table that the mean of metacognition of rural students is 86.33 and urban students for the same variable is 91.09 respectively. The S.D. values are 10.71 and 10.56 for rural and urban senior secondary school students. The calculated C.R. value is 5.47 with the degree of freedom 598.

Interpretation of the result

In the above table and Bar diagram it is shown that the mean scores of rural and urban senior secondary school students are significantly differ from each other. The C.R. value is higher than the tabulated value at 0.05 level, Therefore the null hypothesis that, there is no significant difference between metacognition of male and female students is rejected because the C.R. value is considerable at 0.05 level. Which is supported by P value because it is higher then 0.05. Thus the generalization can be made that the Urban student's metacognition level is higher then rural students.

DISCUSSION

As above the findings indicated that the metacognition of rural and urban students is different. my research finding was also supported by other researches such as, **K.parviz, Masoud sharifi (2011)**, investigated that residential location is also effective in using these strategies. Urban students' metacognition level is higher than rural students. The study of **Selva Bakkaloglu(2020)**, shows the scores of metacognitive awareness differ significantly in relation to their locality(rural vs urban). The metacognition awareness of those students studying in urban areas are higher in comparison to those studying in rural areas.

Objective no.3 – To study the relationship between metacognition and problem solving ability of senior secondary school students .

3. Analysis.

According to Ho3 **“There is no significant relationship between the metacognition and problem solving ability of senior secondary school students” .**

For the verification of above hypothesis the researcher administered a metacognitive inventory and problem solving ability test on 300 urban and 300 rural senior secondary school students Data is analysed and tabulated as follow:

Table No.3

Mean, coefficient of Correlation (r) of Metacognition and Problem Solving Ability of Senior Secondary School Students.

Name of variables	N	M	r	Result
Metacognition	600	88.71	.312	Significant
Problem solving ability	600	9.90		

Level of significance at $0.05 = .088$

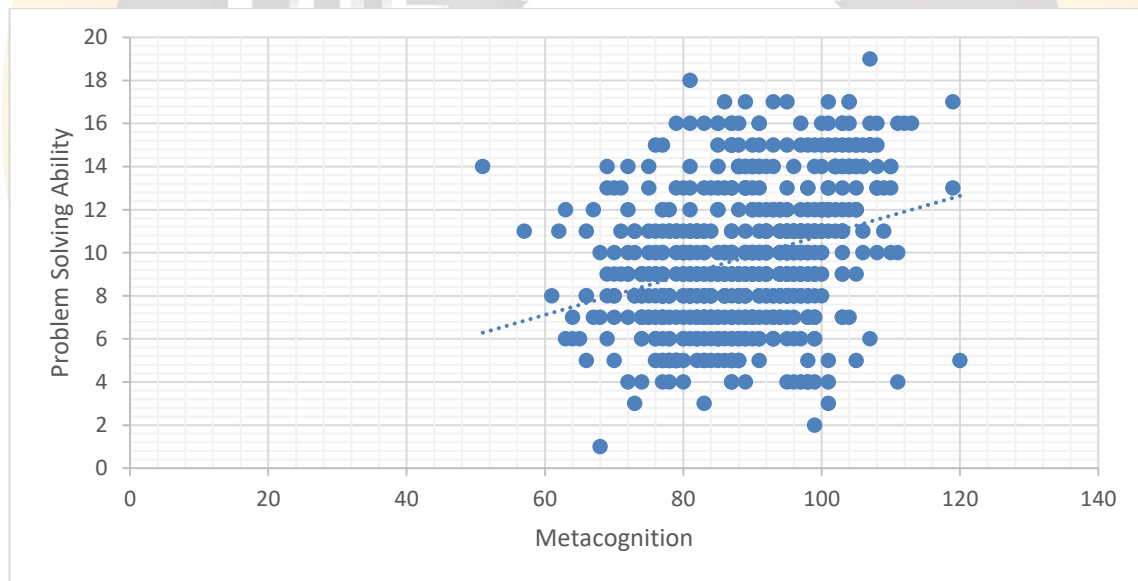


Figure-3

A Scattered diagram displaying correlation between metacognition and problem solving ability of senior secondary school students

Analysis of the result- As shown in above table the metacognition's mean value is 88.71 and problem solving ability mean value is 9.90 and the correlation value of metacognition and problem solving ability is .312 .

Interpretation of the result- It is obvious from the table that the correlation value is .312 which is significant at the 0.05 level. Therefore the null hypothesis that “There is no significant relationship between metacognition and problem solving ability of senior secondary school students” is rejected. Hence it can be said that there is a positive significant relationship between adversity quotient and problem solving ability.

Discussion- Interpretation of table and Scattered diagram shows that metacognition and problem solving ability are correlated with each other .Many researches are supporting this finding such as , L R Izzati et. al, (2018), explored the effects of metacognition on pupils performance when solving mathematical problems.The study's findings showed that students' ability to solve mathematical problems improves with increasing levels of metacognition. Anandaraj, and Ramesh(2014), reported a significant correlation between students metacognition and problem solving ability. The findings of the current research revealed that metacognitive problem-Solving instruction affected the students problem solving skills.

Conclusion- The study found a significant difference between metacognition of female and male senior secondary school students. Female students having higher level of metacognition in comparison to male students. Further it was found that location also effect on metacognition of the students, hence urban senior secondary school students possess high level of metacognition than rural senior secondary school students. Further the study found out the positive correlation between metacognition and problem solving ability.

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