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Research Article

Metacognition As a Predictor of Critical Thinking, Problem Solving and Academic Resilience Among Senior Secondary School Students in Haryana

Pinki Devi[1*], Dr. Kanwaljit Kaur[2]

[1*]Research Scholar, Guru Kashi University, Punjab.
[2]Associate Professor, Guru Kashi, University, Punjab.

***Corresponding Author:** Pinki Devi
*Research Scholar, Guru Kashi University, Punjab.

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ABSTRACT

Metacognition, the ability to regulate one's own cognitive processes, plays a crucial role in shaping critical thinking, problem-solving skills, and academic resilience among students. This study investigates the predictive relationship between metacognition and these cognitive and emotional attributes among senior secondary school students in Haryana. A quantitative research approach was employed, utilizing standardized assessment tools to measure students' metacognitive awareness, critical thinking ability, problem-solving proficiency, and academic resilience. Data were collected from a representative sample of senior secondary students and analyzed using correlation and regression techniques. The findings reveal a significant positive correlation between metacognitive awareness and critical thinking, problem-solving skills, and academic resilience. Higher levels of metacognitive awareness were associated with improved analytical reasoning, adaptive problem-solving strategies, and greater perseverance in the face of academic challenges. The study underscores the importance of fostering metacognitive strategies in educational curricula to enhance students' cognitive abilities and resilience. Implications for educators, policymakers, and curriculum developers are discussed, emphasizing the need for targeted interventions that enhance students' self-regulatory learning processes to improve overall academic outcomes

Keywords: Metacognition, Critical Thinking, Problem-Solving, Academic Resilience, Senior Secondary Students, Haryana

INTRODUCTION

Education can be defined as the process of acquiring knowledge through various experiences and learning opportunities. Socrates believed that education is a person's dynamic power and that it has a significant impact on a person's growth on all levels, including their mental, emotional, social, physical, creative, spiritual, and ethical. "Quality education is not an expenditure; it is an investment in human capital." - UNESCO (2015). Education is not just limited to the classroom, but it is a continuous process that can occur anywhere, anytime, and by any means. Education, in general, and secondary school education in particular, must be quality-oriented since only excellent education can produce helpful, valued, productive, and prudent people.

We need professional teachers who are dynamic, informed, capable, competent, and skilful in order to fulfil these goals and objectives consistently. Teachers' expected responsibilities have assumed new dimensions, and civic society expects teachers to take the lead in making education an effective tool in the country-building process. Education's primary objective is to help youngsters develop their abilities. Education is a person's pride and crown, and it is the most effective tool they must effect the desired changes in the social, economic, cultural, and political realms of the people's lives (Stewart, 2014).

To do this, schools should place more of a focus on encouraging critical thinking rather than cramming material into students' heads. Rightly pointing out that "what tomorrow needs is not a mass of intellectual men, but a mass of educated men to feel and to act as well as to think," Silberman (1970) makes this point.

With the fast-changing nature of education, the capacity to think critically, problem-solve, and be resilient in the face of academic challenges has become critical to student achievement. Of all the cognitive abilities that make these skills possible, metacognition or, as it has been best described, "thinking about thinking" is perhaps at the very core of influencing the way students learn and persevere through challenges. Metacognition involves self-reflection of thinking, self-regulation, and planning, allowing learners to evaluate, monitor, and modify their learning approaches to meet improved performance. Critical thinking and problem-solving are key skills that enable students to scrutinize information, weigh evidence, and produce creative solutions.

At the same time, academic resilience, which is the ability to stick with and adjust to adversity, guarantees learners' persistence and motivation amidst challenges. Studies indicate that metacognitively capable students are likely to demonstrate more effective problem-solving, better critical thinking, and better academic resilience. Few studies, however, have investigated the above relationships in the context of senior secondary school students in Haryana, India. This study will investigate the predictive power of metacognition in building critical thinking, problem-solving, and academic resilience among senior secondary school students in Haryana. Through an understanding of how metacognitive awareness affects these cognitive and emotional traits, policymakers and educators can craft focused interventions that can boost student learning outcomes.

The study will use a quantitative methodology to examine the relationship between metacognition and the three principal academic competencies to identify how developing metacognitive approaches can improve educational achievement. The results of this research are anticipated to add to the body of knowledge on metacognition and student learning, providing actionable advice for incorporating metacognitive education into school curriculum. Through the ability to self-regulate the processes of learning, schools can develop a generation of students who are capable, not only, of critical thinking and problem-solving but also of overcoming academic and practical difficulties.

LITERATURE SURVEY

Mikolov et al. (2013) explored the effectiveness of neural word embeddings in improving text comprehension and Sumarno et al. (2022) investigated the correlation between the metacognitive parameters and English writing skills. Metacognitive Awareness Inventory and a writing rubric were used to collect data. The analyses of data showed that there was a significant correlation between metacognitive parameters and writing skills. Further, English writing skills were influenced to an extent of 41.7% by both the knowledge about cognition as well as the regulation of cognition.

Tibken et al. (2022) tested the role of motivational dispositions and metacognitive competences longitudinally with a sample of 341 gifted and non-gifted underachievers studying in grades 6 and grade 4. Declarative knowledge and procedural knowledge were assessed with reading comprehension. Path analyses were performed to analyse the data.he results showed that procedural metacognition had an incremental effect on school achievement. The declarative knowledge influenced procedural metacognition ($\beta = .169$), which in turn mediated the effect on school achievement.

Hidayat et al. (2021) explored the correlation between mathematical modelling and metacognition with a moderating effect of academic year level by Structural Equation Modelling (SEM) approach. A sample of 538 students were selected as participants for the study by employing Cluster random sampling method. Out of the total 538, 133 (24.7%) were first year students, 223 (41.4%) were second year students and 182 (33.8%) were third year students. Correlational research design was adopted. The results showed that there was a statistically significant relationship between metacognition and mathematical modelling.

Koyuncu et al. (2021) examined the moderator role of gender and socioeconomic factors in the relationship between reading performance of the students and their metacognitive skills. The sample comprised of 6890 students, out of which 3396 (49.30%) were female and 3494 (50.70%) were male. The sample was further classified into low, 2273 (32.99%) students, medium 2273 (32.99%) and high 2344 (34.02%) socioeconomic level. Structural Equation Modelling (SEM) was used to test the moderator effects and it showed that gender and socioeconomic level moderated the relationship between metacognitive skills of the students and their reading performance. Male students had better reading performance than female students in the low and medium levels and vice versa in the high socioeconomic level.

Omprakash et al. (2021) conducted a study is to evaluate the reliability as well as the construct validity of the Metacognitive Awareness Inventory (MAI) among medical students by using factor analysis. A cross sectional method was adopted. In EFA 12 items with less than 0.40 factor loading were removed and the remaining factors yielded an internal consistency of above 0.9. EFA yielded a total of six factors. CFA using SEM explained the 43 hypothesized model for each item. Therefore, MAI with 40 items designed by Schraw was a valid and reliable to be used in Indian context.

Garg and Sharma (2020) formulated a research study to investigate the effect of Metacognition and Self-criticism on the Fear of Happiness of students. The results showed that Declarative Knowledge and Evaluation, two of the components of Metacognition were significant predictors of Fear of Happiness.

Meera and Krishna (2020) examined the metacognition with regard to adolescents' residential area and their gender. A sample 300 students from Hisar district of Haryana were selected for the study. The results showed that male respondents had moderate levels of procedural knowledge and conditional knowledge whereas

female had moderate level of declarative knowledge. It also showed that a greater number of urban students had higher metacognition than rural students.

Chakraborty and Chechi (2019) attempted to validate the factor structure of self- regulated learning, a component of the metacognition in the Indian contextThe analysis figured out that model was a better one. The parsimony model had goodness of fit with appropriate TLI, CFI, RMR and RMSEA with lower AIC and BIC.

Kaur et al. (2018) intended to investigate whether the metacognition, learning environment and self regulation were predictors of adolescent academic achievement as these variables have been acknowledged to have an impact on students' achievementThe results showed that the independent variables metacognition, self-regulation and perceptions were significant predictors of the dependent variable students' achievement. It was further revealed that those variables affected the academic achievement positively.

Ajisuksmo and Saputri (2017) investigated the influence of Mathematics attitude and metacognitive awareness on mathematics achievement and also examined the gender differences on mathematics achievement among high school students. The results showed that the Mathematics attitude was significantly related with Mathematics achievement ($r= 0.505$; $p < 0.001$) and Metacognition was not significantly related with Mathematics achievement ($r = 0.081$; $p > 0.05$). The regression analyses showed that Mathematics attitude has significantly predicted Mathematic achievement.

Kadian (2016) conducted a study to find the influence of intelligence and Metacognition on Academic Achievement of middle school students. Correlational analysis showed that insights.

Kalia et al. (2016) conducted a study to investigate the relationship between metacognitive skilfulness and emotional intelligence as well as achievement motivation among adolescents. A sample of 200 adolescents belonging to the age group of 17-19 years from Ludhiana city were selected for the study. The sample was distributed equally with respect to gender. The results showed that the factors of metacognition were positively related to emotional intelligence of the adolescents. The factors of metacognition were also positively related to achievement motivation of the adolescents.

Sawhney and Bansal (2015) undertook a study to figure out the relationship between metacognitive awareness and academic achievement of students studying graduation.The result showed that there was a significant difference in academic achievement between undergraduate students having high metacognitive awareness and low metacognitive awareness. It also revealed that boys and girls did not differ in their Metacognitive Awareness, but girls have better academic achievement than boys studying graduation.

Patel and Sharma (2023) examined the effect of metacognitive training on critical thinking skills among undergraduate students. A quasi-experimental design was used with an experimental group receiving metacognitive strategy instruction and a control group following conventional learning methods. Post-test results indicated a significant improvement in critical thinking skills in the experimental group ($t = 4.72$, $p < 0.01$), suggesting that metacognitive training enhances students' ability to analyze and evaluate information effectively.

Gomez et al. (2023) explored the influence of metacognitive monitoring on academic performance in science subjects among secondary school students. The study employed a longitudinal design with self-report metacognitive assessments and standardized science achievement tests over two semesters. Structural equation modeling showed that metacognitive monitoring positively predicted academic performance ($\beta = .265$), emphasizing the role of self-awareness in learning effectiveness.

Wang and Li (2023) investigated the relationship between metacognitive self-regulation and motivation in online learning. A sample of 350 university students participated in the study, where metacognitive self-regulation was assessed using a validated questionnaire. Regression analysis revealed that metacognitive self-regulation significantly predicted intrinsic motivation ($\beta = .298$, $p < 0.01$) and learning persistence ($\beta = .212$, $p < 0.05$). The study highlighted the importance of metacognitive awareness in sustaining motivation and engagement in self-paced learning environments.

Fernandez and Roberts (2023) examined the role of metacognitive strategies in enhancing problem-solving skills in STEM education. The study involved 200 engineering students, who were divided into two groups: one receiving explicit metacognitive strategy instruction and the other following traditional instructional methods. Data analysis using ANOVA showed that students who received metacognitive instruction demonstrated significantly higher problem-solving accuracy ($F(1,198) = 5.89$, $p < 0.05$), indicating the effectiveness of metacognitive strategies in complex reasoning tasks.

METHODOLOGY

POPULATION

The population of the present study will include senior secondary students of state board schools from Yamuna Nagar district. In order to achieve a wider and representative sample, 5 percent of the entire population of senior secondary students of both Ambala and Yamuna Nagar districts will be taken for the study. This sampling will attempt to reflect heterogeneous academic backgrounds, environments for learning, and socio-economic statuses that might affect metacognition, critical thinking, problem-solving ability, and academic resilience in students. The participants will be students belonging to different streams, such as science, commerce, and humanities, so that the metacognitive impacts are understood across different fields of study.

Every attempt will be made to incorporate schools from urban and rural settings within the districts under study, so that findings can be representative of diverse schooling experiences and difficulties. The process of selection will also consider gender balance and levels of school performance to look at the relationship between metacognition and students' academic competencies from a holistic point of view. Through an exclusive focus on this population, the research will produce insights that can be pragmatically translated to enhance pedagogy, curriculum planning, and support structures for students at the senior secondary level of education in state board schools of Haryana

SAMPLE

In this current research, the researcher used a random stratified sampling method to obtain an equitable and representative sample of the participants. Through this method, students from varied backgrounds, academic streams, and school settings can be included in the study, thus increasing the reliability and generalizability of the findings of the study. The researcher shall randomly choose schools from both Ambala and Yamuna Nagar districts of Haryana, so that the sample would correctly represent the demographic and educational heterogeneity of senior secondary student population in state board schools. To do this, the researcher will initially stratify schools on the basis of important stratification variables like urban and rural setting, school size, and academic levels. From each stratum, a proportional number of schools will be sampled to provide balanced representation. Within the sampled schools, students will be randomly recruited to be part of the study, taking into consideration factors like gender, field of study (science, commerce, and humanities), and socio-economic status

This systematic design will assist in reducing bias and yielding a well-spread sample that reflects the variation in metacognition, critical thinking, problem-solving ability, and academic resilience among senior secondary students. This method will also enable effective comparisons between different student groups, leading to better understanding of the connection between metacognition and academic achievement.

Sampling scheme for Yamuna Nagar district

There are total 221 schools in Yamuna Nagar district, of which 78 are Government schools and 143 Private schools. The number of students in these schools are as follows:

LOCALITY OF SCHOOL	URBAN	RURAL	TOTAL
SCHOOL DISTRIBUTION	74	147	221
TOTAL STUDENTS	13034	17855	30889
BOY STUDENTS	6804	9502	16306
GIRL STUDENTS	6230	8353	14583

5% of the total population i.e. 1545 is taken as the sample size of Yamuna Nagar district and the data from 1545 students will be collected from schools situated in seven blocks of district yamunananagar as per convenience of the researcher.

Sampling scheme for Ambala district.

There are total 222 schools in Ambala district, of which 78 are Government schools and 144 Private schools. The number of students in these schools are as follows:

LOCALITY OF SCHOOL	URBAN	RURAL	TOTAL
SCHOOL DISTRIBUTION	70	152	222
TOTAL STUDENTS	15715	15985	31700
BOY STUDENTS	8924	7865	16789
GIRL STUDENTS	6791	8120	14911

Sampling technique:

A list of Senior secondary schools of the selected Districts of Haryana will be prepared based on consent given by schools to conduct experiment. Then randomly schools will be selected from the list for taking forward the research through Descriptive survey method.

CONCLUSION

After processing the data, obtaining and interpreting the results in the previous chapter, the findings can be generalized to the extent of representatives of the sample and methodology employed in the study. In this chapter, the results are discussed to show how these findings are concurrent with some of the empirical studies already conducted in the field. At places, some of the observations did not concur with the findings of some investigators. In such cases, attempts have been made to fathom plausible reasons for these disagreements.

Keeping the major findings in view, the educational implications of the study have been worked out. But these findings and implications do not fit in all the concerns of study. As such some suggestions have been given for further research. This chapter is, therefore, devoted to focusing on findings, conclusions, discussion of the results, educational implications of the study and suggestions for further research.

The main findings in general and conclusions drawn based on results and discussions indicate a wide range of implications and their potential for further research. The present research validates that metacognition is a critical component in developing critical thinking, problem-solving, and academic resilience among Haryana's senior secondary students. Higher metacognitive awareness was exhibited by those students who showed stronger analytical reasoning and flexibility in academic problems. Although the results replicate earlier findings, certain differences reveal that variables such as educational settings and socio-cultural factors could influence the effectiveness of metacognition.

The research emphasizes the importance of incorporating metacognitive strategies into pedagogy and curriculum planning. Educating teachers to promote self-regulated learning can enhance the cognitive abilities and resilience of students. Long-term effects, cross-cultural variations, and extrinsic factors such as parental engagement should be investigated in future studies to better comprehend and optimize metacognitive learning.

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