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Research Article

Relationship Of Anxiety, Metacognition, Resilience, And Problem- Solving Skills With Academic Achievement Among Secondary School Students

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ABSTRACT

This study investigates the relationship of anxiety, metacognition, resilience, and problem-solving skills as with academic achievement among secondary school students using a descriptive survey method. A sample of 400 students from the Amritsar district, selected through random sampling, participated in the study. Standardized tools were employed to measure the variables, including the Academic Anxiety Scale for Children (Singh & Gupta, 2009), the Metacognitive Skills Scale (Gupta & Suman, 2017), the Psychological Resilience Scale (Kumari & Yadav, 2019), and the Problem-Solving Ability Test (Dubey & Mathur, 2019). Academic achievement was determined based on students' scores in their previous class. The findings revealed significant differences in anxiety levels based on gender and location, with male and female students, as well as urban and rural students, showing distinct mean scores. Similarly, metacognition levels differed significantly between urban and rural students but not between male and female students. In contrast, no significant differences were observed in psychological resilience and problem-solving skills across gender or location. Furthermore, the study found a significant relationship between anxiety, metacognition, psychological resilience, and problem-solving skills with academic achievement among secondary school students, highlighting the influence of these psychological variables on academic performance.

Keywords: Anxiety, Metacognition, Resilience, Problem-Solving Skills, Academic Achievement, Secondary School Students

Introduction

Academic achievement is a cornerstone of students' overall development and a key predictor of their future success. Among the myriad factors influencing academic outcomes, psychological and cognitive variables such as anxiety, metacognition, resilience, and problem-solving skills play pivotal roles. Anxiety, characterized by excessive worry and tension, is a common issue among secondary school students and can significantly impede learning and performance (Spielberger, 1983). Excessive academic anxiety has been linked to reduced focus, poor time management, and lower academic achievement (Cassady & Johnson, 2002). Conversely, metacognition—the awareness and regulation of one's cognitive processes—has emerged as a powerful enabler of academic success. Students with strong metacognitive skills are better equipped to plan, monitor, and evaluate their learning strategies, leading to improved performance across subjects (Schraw & Dennison, 1994). Resilience, defined as the capacity to adapt effectively to adversity, also contributes significantly to students' academic outcomes. Resilient students demonstrate higher perseverance and adaptability, enabling them to overcome academic challenges and maintain consistent performance (Masten, 2001). Similarly, problem-solving skills, which encompass the ability to analyze, evaluate, and resolve complex situations, are essential for academic success, particularly in science, commerce, and arts streams where analytical thinking is critical (Heppner & Petersen, 1982). While individual factors like anxiety, metacognition, resilience, and problem-solving skills are known to influence academic achievement, their combined impact remains underexplored, especially in the context of secondary school students in diverse settings. This study seeks to address this gap by examining the relationships between these variables and academic achievement, shedding light on gender and urban-rural disparities to inform targeted interventions.

Anxiety: Anxiety is a state of heightened arousal and apprehension often accompanied by physical symptoms such as increased heart rate and sweating. It may arise due to perceived threats, challenges, or stressful situations, and when persistent, it can impair an individual's ability to function effectively (Singh & Gupta, 2009). In academic contexts, anxiety manifests as fear or nervousness related to academic tasks, tests, or performance, potentially hindering learning and achievement.

Metacognition: Metacognition refers to the awareness and regulation of one's own thought processes. It involves planning, monitoring, and evaluating cognitive activities to enhance learning and problem-solving (Flavell, 1979). Students with strong metacognitive skills can adapt strategies for better understanding and performance in academic tasks (Gupta & Suman, 2017).

Resilience: Resilience is the psychological capacity to bounce back from adversity, cope with challenges, and maintain mental well-being despite setbacks. It encompasses emotional regulation, perseverance, and adaptability (Kumari & Yadav, 2019). Resilient students are better equipped to handle academic stress and setbacks, contributing to sustained academic success.

Problem-Solving Skills: Problem-solving skills involve the ability to identify, analyze, and develop solutions for complex situations or challenges. These skills require critical thinking, creativity, and logical reasoning (Dubey & Mathur, 2019). In educational settings, students with strong problem-solving abilities are better able to tackle academic tasks effectively, enhancing performance.

Academic Achievement: Academic achievement refers to the measurable performance outcomes of students in educational settings, typically indicated by grades, test scores, or other evaluative criteria (Singh & Gupta, 2009). It reflects the extent to which a student has achieved learning objectives and mastered curriculum content, serving as a key indicator of educational success.

Literature Reviews:

Recent studies have explored the intricate relationships between cognitive, emotional, and psychological factors that influence academic achievement among secondary school students. High levels of anxiety are inversely related to academic achievement, as anxiety interferes with cognitive processing and task focus. However, the type and context of anxiety play significant roles; moderate levels may sometimes act as a motivator for performance (Camacho-Morles et al., 2021; Carey et al., 2017). A meta-analysis by Caviola et al. (2021) confirms that math anxiety significantly hinders performance, particularly in high-stakes testing environments. Metacognitive strategies, such as planning, monitoring, and evaluating one's learning processes, have a strong positive relationship with academic achievement. Effective metacognitive practices empower students to approach problems systematically, improving their learning outcomes (Zulkiply, 2009; Michelli, 2013). Moreover, metacognition mediates the effects of anxiety, allowing students to redirect their focus to constructive problem-solving (Chiu et al., 2021). Resilience helps students adapt to academic stressors and maintain performance despite challenges. Research highlights that students with high resilience levels perform better academically due to their ability to manage stress and sustain motivation (Fletcher & Sarkar, 2013; Yang & Wang, 2021). Academic resilience is particularly critical in socioeconomically disadvantaged contexts, where external stressors are more prevalent (Frontiers, 2021). Problem-solving ability is a strong predictor of academic success, as it directly correlates with higher-order cognitive functions. Students with advanced problem-solving skills demonstrate better adaptability and efficiency in learning environments, significantly boosting their academic outcomes (Beyazsacli, 2016). These findings underline the interconnectedness of psychological and cognitive factors in academic settings.

Emergence of the Study: The study of anxiety, metacognition, resilience, and problem-solving skills as predictors of academic achievement has gained significant attention in educational psychology due to its implications for student development and success. Academic anxiety, defined as the apprehension students experience in academic settings, has been widely recognized as a barrier to optimal performance (Singh & Gupta, 2009). High levels of anxiety can negatively affect cognitive processes like attention and memory, leading to lower academic outcomes. Conversely, metacognition, or the ability to reflect on and regulate one's cognitive processes, has been linked to improved problem-solving and learning efficiency, making it a critical factor in educational achievement (Gupta & Suman, 2017). Resilience, the capacity to adapt and recover from adversity, has emerged as a key protective factor that supports students in managing stress and maintaining academic performance under challenging circumstances (Kumari & Yadav, 2019). Similarly, problem-solving skills, which involve identifying solutions to complex or unfamiliar situations, are foundational to success across disciplines and correlate strongly with academic achievement (Dubey & Mathur, 2019). These constructs are particularly relevant for secondary school students, a population navigating significant academic and developmental challenges. The interplay between these psychological factors and academic success underscores the need for comprehensive studies to explore their predictive power and interrelationships. This

study, grounded in empirical evidence and using validated tools, addresses this gap, offering insights to educators, psychologists, and policymakers to enhance student achievement through targeted interventions.

Hypotheses of the study

1. There is no significant difference in the mean scores of anxiety among male and female secondary school students.
2. There is no significant difference in the mean scores of anxiety among urban and rural secondary school students.
3. There is no significant difference in the mean scores of metacognition among male and female secondary school students.
4. There is no significant difference in the mean scores of metacognition among Urban and Rural secondary school students.
5. There is no significant difference in the mean scores of psychological resilience among male and female secondary school students.
6. There is no significant difference in the mean scores of psychological resilience among urban and rural secondary school students.
7. There is no significant difference in the mean scores of problem-solving skills among male and female secondary school students.
8. There is no significant difference in the mean scores of problem-solving skills among urban and rural secondary school students.
9. There is no significant relationship of anxiety, metacognition, psychological resilience, problem solving skills with academic achievement among secondary school students.

Methodology

Research method: The present study falls under the domain of descriptive research.

Sample: The sample consisted of 400 secondary school students from 11th grade, selected using a random sampling technique from various schools in the Amritsar district.

Tools Used:

The following tools were used for the study:

- Academic anxiety scale for children developed by Singh and Gupta (2009)
- Metacognitive skills scale developed by Gupta and Suman (2017)
- Psychological Resilience scale developed by Kumari and Yadav (2019).
- Problem solving ability test developed by Dubey and Mathur (2019).
- Academic Achievement will be the scores obtained by the students in their previous class.

Interpretation and Discussions

HYPOTHESIS 1: There is no significant difference in the mean scores of anxiety among male and female secondary school students.

To test this hypothesis, Mean and S.D., S. E_M, and t- value of anxiety among secondary school students with respect to gender and locale were calculated and have been described in terms of mean, S.D., and t-value in the table 1.

Table 1: Mean, S.D., S. E_M, and t- value of anxiety of secondary school students with respect to gender and locale

Variable Anxiety	Category	N=400	Mean	S.D.	S. E_M	t- value
Gender	Male	200	56.58	19.75	1.39	**2.80**
	Female	200	62.26	20.85	1.47	
Locale	Urban	200	64.78	20.45	1.44	**5.41**
	Rural	200	54.06	19.11	1.35	

Table 1 indicates that the sample size (N) for each group (male and female) is 200. The mean anxiety score for male students is 56.58, with a standard deviation (S.D.) of 19.75 and a standard error of the mean (S.EM) of 1.39. For female students, the mean anxiety score is 62.26, with a standard deviation of 20.85 and an S.EM of 1.47. The calculated t-value for the difference in mean anxiety scores between males and females is 2.80. For a two-tailed test with degrees of freedom (df = 398), the critical t-value at 0.01 significance level is approximately 2.58. Since the calculated t-value (2.80) exceeds the critical value, the null hypothesis is rejected. Thus, there

is a significant difference in the mean anxiety scores between male and female secondary school students. Female students exhibit higher mean anxiety scores compared to male students. The hypothesis that **There is no significant difference in the mean scores of anxiety among male and female secondary school students** is **rejected** at the 0.01 level of significance.

Hypothesis 2: There is no significant difference in the mean scores of anxiety among urban and rural secondary school students.

To test this hypothesis, Mean and S.D., S. E_M, and t- value of anxiety among secondary school students with respect locale were calculated and have been described in terms of mean, S.D., and t-value in the table 1 and it reveals that the sample size (N) for urban and rural students is 200 each. Urban students have a mean anxiety score of 64.78, with an S.D. of 20.45 and an S.EM of 1.44. Rural students have a mean anxiety score of 54.06, with an S.D. of 19.11 and an S.EM of 1.35. The calculated t-value for the difference in mean anxiety scores between urban and rural students is 5.41. At the 0.01 level of significance, the critical t-value for a two-tailed test with df = 398 is 2.58. The calculated t-value (5.41) is greater than the critical value. Thus, the null hypothesis is rejected. There is a significant difference in the mean anxiety scores between urban and rural secondary school students. Urban students have significantly higher mean anxiety scores compared to rural students. The hypothesis that **There is no significant difference in the mean scores of anxiety among urban and rural secondary school students** is **rejected** at the 0.01 level of significance.

Hypothesis 3: There is no significant difference in the mean scores of metacognition among male and female secondary school students.

To test this hypothesis, Mean and S.D., S. E_M, and t- value of metacognition among secondary school students with respect to gender and locale were calculated and have been described in terms of mean, S.D., and t-value in the table 2.

Table 2: Mean, S.D., S. E_M, and t- value of metacognition of secondary school students with respect to gender and locale

Variable Metacognition	Category	N=400	Mean	S.D.	S. E_M	t- value
Gender	Male	200	112.16	19.79	1.40	**7.17**
	Female	200	95.31	26.64	1.88	
Locale	Urban	200	106.56	27.34	1.93	**2.28**
	Rural	200	100.91	21.92	1.55	

Table 2 indicates a notable difference in the mean scores. The mean score of metacognition for male students (N = 200) is 112.16, with a standard deviation (S.D.) of 19.79, and a standard error of the mean (S.E.M.) of 1.40. In contrast, the mean score for female students (N = 200) is 95.31, with an S.D. of 26.64 and an S.E.M. of 1.88. The calculated t-value for the difference in mean scores is 7.17. At the 0.01 level of significance, the critical value for t (for degrees of freedom = 398) 2.58 is lower than the calculated t-value of 7.17. This indicates that the difference in mean scores is statistically significant. There is a significant difference in the metacognition scores between male and female secondary school students. Therefore, the null hypothesis is **rejected**, and it can be concluded that gender has a significant impact on the metacognition levels of secondary school students.

Hypothesis 4: There is no significant difference in the mean scores of metacognition among urban and rural secondary school students.

To test this hypothesis, Mean and S.D., S. E_M, and t- value of metacognition among secondary school students with respect locale were calculated and have been described in terms of mean, S.D., and t-value in the table 2 and it reveals the mean score of metacognition for urban students (N = 200) is 106.56, with an S.D. of 27.34 and an S.E.M. of 1.93. For rural students (N = 200), the mean score is 100.91, with an S.D. of 21.92 and an S.E.M. of 1.55. The calculated t-value for the difference in mean scores is 2.28. At the 0.01 level of significance, the critical t-value for degrees of freedom = 398 is approximately 2.58. Since the observed t-value of 2.28 does not exceeds the critical value, the difference in mean scores is not statistically significant. There is no significant difference in the metacognition scores between urban and rural secondary school students. Therefore, the null hypothesis **There is no significant difference in the mean scores of metacognition among urban and rural secondary school students** is **accepted**, indicating that the locale (urban or rural) influences the metacognition levels of secondary school students.

Hypothesis 5: There is no significant difference in the mean scores of psychological resilience among male and female secondary school students

To test this hypothesis, Mean and S.D., S. E_M, and t- value of psychological resilience among secondary school students with respect to gender and locale were calculated and have been described in terms of mean, S.D., and t-value in the table 3.

Table 3: Mean, S.D., S. E_M, and t- value of psychological resilience of secondary school students with respect to gender and locale

Variable Psychological Resilience	Category	N=400	Mean	S.D.	S. E_M	t- value
Gender	Male	200	120.82	31.86	2.25	**5.31**
	Female	200	103.67	32.70	2.31	
Locale	Urban	200	116.84	33.70	2.38	**2.78**
	Rural	200	107.65	32.47	2.29	

Table 3 reveals the psychological resilience scores of male (N=200) and female (N=200) secondary school students were analysed to test this hypothesis. The mean score for males was 120.82, with a standard deviation (S.D.) of 31.86 and a standard error of mean (S.EM.) of 2.25, while for females, the mean score was 103.67, with an S.D. of 32.70 and an S.EM. of 2.31. The calculated t-value for the difference in means was 5.31. At the 0.01 level of significance, the critical value of t (two-tailed) for 398 degrees of freedom is 2.58. Since the obtained t-value (5.31) is greater than the critical value, the difference in mean scores is statistically significant. Thus, the null hypothesis that **There is no significant difference in the mean scores of psychological resilience among male and female students** is **rejected**. This indicates that male students exhibit significantly higher psychological resilience than female students.

Hypothesis 6: There is no significant difference in the mean scores of psychological resilience among urban and rural secondary school students

To test this hypothesis, Mean and S.D., S. E_M, and t- value of psychological resilience among secondary school students with respect to locale were calculated and have been described in terms of mean, S.D., and t-value in the table 3 and it shows the psychological resilience scores of urban (N=200) and rural (N=200) secondary school students were analyzed to test this hypothesis. The mean score for urban students was 116.84, with an S.D. of 33.70 and an S.EM. of 2.38, while for rural students, the mean score was 107.65, with an S.D. of 32.47 and an S.EM. of 2.29. The calculated t-value for the difference in means was 2.78. At the 0.01 level of significance, the critical value of t (two-tailed) for 398 degrees of freedom is 2.58. Since the obtained t-value (2.78) exceeds the critical value, the difference in mean scores is statistically significant. Thus, the hypothesis that **There is no significant difference in the mean scores of psychological resilience among urban and rural students is rejected**. This indicates that urban students exhibit significantly higher psychological resilience than rural students.

Hypothesis 7: There is no significant difference in the mean scores of problem-solving skills among male and female secondary school students.

To test this hypothesis, Mean and S.D., S. E_M, and t- value of problem-solving skills among secondary school students with respect to gender and locale were calculated and have been described in terms of mean, S.D., and t-value in the table 4.

Table 4: Mean, S.D., S. E_M, and t- value of problem-solving skills of secondary school students with respect to gender and locale

Variable Problem-Solving Skills	Category	N=400	Mean	S.D.	S. E_M	t- value
Gender	Male	200	12.72	1.64	0.12	**6.30**
	Female	200	11.55	2.04	0.14	
Locale	Urban	200	12.37	1.54	0.11	**2.43**
	Rural	200	11.90	2.25	0.16	

In Table 4 shows that the male students (N = 200) have a mean score of 12.72, with a standard deviation (S.D.) of 1.64 and a standard error of the mean (S.E.M.) of 0.12. On the other hand, female students (N = 200) have a mean score of 11.55, with a higher standard deviation of 2.04 and an S.E.M. of 0.14. The calculated t-value is 6.30, which is significantly higher than the critical value at the 0.01 level of significance for the given degrees of freedom (398). This indicates that the difference in the mean scores of problem-solving skills between male and female students is statistically significant. Thus, the null hypothesis stating that **"there is no significant difference in the mean scores of problem-solving skills among male and female secondary school students" is rejected**. This suggests that male students exhibit significantly higher problem-solving skills compared to female students.

Hypothesis 8: There is significant difference in the mean scores of problem-solving skills among urban and rural secondary school students.
To test this hypothesis, Mean and S.D., S. E_M, and t- value of psychological resilience among secondary school students with respect to locale were calculated and have been described in terms of mean, S.D., and t-value in the table 4 and data for urban and rural students highlights a smaller difference in their problem-solving skills. Urban students (N = 200) have a mean score of 12.37, with a standard deviation of 1.54 and an S.E.M. of 0.11. Rural students (N = 200) have a slightly lower mean score of 11.90, with a higher standard deviation of 2.25 and an S.E.M. of 0.16. The calculated t-value is 2.43, which, while indicating some difference, does not exceed the critical value at the 0.01 level of significance for the given degrees of freedom. This means that the observed difference in the mean scores is not statistically significant at this stringent level. Therefore, the null hypothesis stating that **"there is no significant difference in the mean scores of problem-solving skills among urban and rural secondary school students" is accepted**. This implies that the problem-solving skills of urban and rural students are not significantly different.

Hypothesis 9: There is no significant relationship of anxiety, metacognition, psychological resilience, problem solving skills with academic achievement among secondary school students
To test this hypothesis, the score of coefficient of correlation of anxiety, metacognition, psychological resilience, problem solving skills with academic achievement among secondary school students have been shown in the table 5.

Table 5: Coefficient of correlation of anxiety, metacognition, psychological resilience, problem solving skills with academic achievement among secondary school students

Variable	Anxiety	Metacognition	Psychological Resilience	Problem Solving Skills
Academic Achievement	-0.41	0.63	0.52	0.69

Table 5 shows the relationship between different psychological variables i.e anxiety, metacognition, psychological resilience, and problem-solving skills and academic achievement among secondary school students.

Interpretation of Each Correlation Coefficient
1. Anxiety and Academic Achievement: The correlation coefficient between anxiety and academic achievement is -0.41, indicating a moderate negative relationship. This suggests that as anxiety levels increase, academic achievement tends to decrease. The negative value implies that anxiety might hinder students' ability to perform well academically.
2. Metacognition and Academic Achievement: The correlation coefficient between metacognition and academic achievement is 0.63, signifying a strong positive relationship. This means that as students' metacognitive skills improve, their academic achievement tends to increase significantly. Metacognition involves awareness and control of one's own learning processes, which likely supports better academic outcomes.
3. Psychological Resilience and Academic Achievement: The correlation coefficient between psychological resilience and academic achievement is 0.52, indicating a moderate positive relationship. This suggests that students with higher psychological resilience are more likely to achieve better academically. Psychological resilience, which reflects the ability to cope with stress and adversity, appears to contribute positively to academic performance.
4. Problem Solving Skills and Academic Achievement: The correlation coefficient between problem-solving skills and academic achievement is 0.69, suggesting a strong positive relationship. This implies that students with better problem-solving skills tend to perform better academically. Problem-solving skills likely enable students to navigate challenges effectively, contributing positively to academic success.

Rejection of the Hypothesis: Since each correlation value (-0.41, 0.63, 0.52 and 0.69) indicates a significant relationship between anxiety, metacognition, psychological resilience, and problem-solving skills and academic achievement among secondary school students. The above results in table 5, provide enough grounds to **reject** the null hypothesis i.e **There is no significant relationship of anxiety, metacognition, psychological resilience, problem solving skills with academic achievement among secondary school students**.

Findings of the Study

1. *Anxiety and Gender:* There is a significant difference in the mean anxiety scores between male and female secondary school students.

2. *Anxiety and Locale:* There is a significant difference in the mean anxiety scores between urban and rural secondary school students.
3. *Metacognition and Gender:* There is no significant difference in the mean metacognition scores between male and female secondary school students.
4. *Metacognition and Locale:* There is a significant difference in the mean metacognition scores between urban and rural secondary school students.
5. *Psychological Resilience and Gender:* There is no significant difference in the mean psychological resilience scores between male and female secondary school students.
6. *Psychological Resilience and Locale:* There is no significant difference in the mean psychological resilience scores between urban and rural secondary school students.
7. *Problem-Solving Skills and Gender:* There is no significant difference in the mean problem-solving skills scores between male and female secondary school students.
8. *Problem-Solving Skills and Locale:* There is no significant difference in the mean problem-solving skills scores between urban and rural secondary school students.
9. *Relationship with Academic Achievement:* There is a significant relationship between anxiety, metacognition, psychological resilience, and problem-solving skills with academic achievement among secondary school students.

Educational Implications

1. Addressing Gender Differences in Anxiety:

- Schools should implement gender-sensitive mental health programs to address the significant differences in anxiety levels between male and female students.
- Counselors and teachers can use targeted strategies, such as mindfulness training or stress management workshops, to help students manage anxiety effectively.

2. Supporting Urban and Rural Students' Mental Health:

- Since anxiety levels differ significantly between urban and rural students, educational policymakers should tailor mental health interventions to address the unique challenges faced by each group.
- Rural students may benefit from increased access to mental health resources, while urban students may require strategies to cope with high-pressure academic environments.

3. Enhancing Metacognitive Skills:

- Metacognition is linked to academic achievement, so schools should integrate training in self-regulation and reflective learning into the curriculum.
- Educators should use instructional techniques like think-aloud strategies, goal-setting, and self-assessment exercises to strengthen students' metacognitive skills.
- Programs to reduce disparities in metacognition between urban and rural students should be prioritized to ensure equal opportunities for success.

4. Fostering Psychological Resilience:

- Though no gender or locale-based differences were found, psychological resilience plays a critical role in academic performance. Schools should foster resilience through activities that promote perseverance, self-efficacy, and adaptability.
- Including extracurricular activities, mentorship programs, and peer-support initiatives can help build resilience among students.

5. Improving Problem-Solving Skills:

- As problem-solving skills significantly relate to academic achievement, incorporating problem-based learning (PBL) into teaching practices can enhance these skills.
- Collaborative learning activities, critical thinking exercises, and real-life problem-solving scenarios should be emphasized in the curriculum to develop these abilities.

6. Holistic Academic Development:

- Since anxiety, metacognition, resilience, and problem-solving skills collectively influence academic performance, schools should adopt a comprehensive approach to address these variables.
- Establishing a supportive and stress-free learning environment can help optimize students' overall academic success.

7. Teacher Training and Awareness:

- Teachers need training to identify and address anxiety, resilience, and other psychological factors affecting student performance.

- Professional development programs should equip educators with tools to promote metacognition and problem-solving skills in their classrooms.

8. Policy and Resource Allocation:

- Educational policymakers should allocate resources to bridge gaps in metacognition and mental health support between urban and rural schools.
- Technology and e-learning tools can be leveraged to provide equitable access to quality education and skill development for students in diverse settings.

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