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Interaction Effects Of Academic Anxiety, Metacognition, Resilience And Problem-Solving Skills On Academic Achievement Of Senior Secondary School Students In India

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Abstract

By combining secondary data, this study investigates how anxiety, metacognition, resilience, and problem-solving skills are linked to academic achievement in senior secondary school students across India. Empirical studies, national reports, and psychological measurement manuals are utilized to construct an integrative model where anxiety is a negative predictor of performance and metacognitive regulation, resilience, or problem-solving act as positive, partially interrelated Predictors. Research indicates that metacognition and problem-solving are effective in enhancing achievement and mediating the effects of anxiety through study strategies and cognitive efficiency, while resilience moderates the harmful impact of stress by encouraging persistence and adaptive coping. The article notes the occurrence of differences among school types and regions, emphasizes measurement limitations in current studies, and advocates for scalable school-level interventions to enhance board-exam results and student well-being. This paper contrasts academic achievement with cognitive challenges within STEM fields. The harmonized instruments are used in longitudinal and intervention research, as well as their methodological implications. The research is designed to inspire teachers, counsellors, and policymakers to develop innovative methods for enhancing academic performance and mental health of senior secondary students in India.

Keywords: Test Anxiety, Metacognition, Resilience, Problem Solving, Academic Achievement.

INTRODUCTION

Considering the increasing academic pressure, competitive exams, and socio-emotional issues faced by senior secondary school students in India, it is crucial to comprehend the factors that influence their academic performance. The study consistently highlights non-cognitive factors that have a significant impact on students' learning outcomes, including

anxiety, metacognition, resilience, and problem-solving skills. Besides how students approach academic tasks, these variables also influence their emotional regulation, ability to handle difficulties in life, and the handling of complex academic challenges. Kumar & Bhukar (2013) assert that the exploration of predictors in the Indian schooling environment, where high-stakes assessments shape educational pathways, is particularly pertinent for educators, policymakers, and school counselors. Having a comprehensive understanding of these dimensions allows for the development of evidence-based interventions to enhance students' academic performance and promote psychological wellness. Additionally, all three dimensions are discussed in greater detail.

Definitions of Key Terms

When a student experiences worry, tension, and other emotions that disrupt their focus and ability to perform well on exams due to anxiety, they are classified as anxiety. Anxiety can lead to cognitive processing and a decline in working memory function during academic tasks (Spielberger, 2010). Culturally emphasized academic exams in India place great importance on anxiety. According to research, intense academic anxiety can have a detrimental effect on concentration, diminish confidence, and hinder performance (Kumar & Bhukar, 2013).

The process of learning and memory management is characterized by learners' self-awareness and ability to control their own thinking. It involves knowledge of strategies, tasks, and self-directed strategies as well as planning, monitoring, evaluating (Flavell, 1979). Successful learning is closely tied to metacognition, which indicates that students who manage their cognition also have better performance in school. For example, strong metacognitive skills are necessary to handle both abstract content and rigorous curricula in senior secondary students (Veenman et al, 2006). This variable is also important for predicting academic achievement. Why?

A state of being resilient is when one finds themselves able to adapt and thrive in the face of hardship, stress, or difficulties. In adolescents, emotional strength, problem-solving skills, and supportive relationships are essential for coping with academic pressures (Masten 2014). The concept of resilience in education is linked to students' determination, motivation, and ability to overcome obstacles such as academic setbacks or failure. Studies indicate that

students with resilience exhibit greater levels of engagement and academic success (Fletcher & Sarkar, 2013).

The ability to solve academic or real-life problems through cognitive and strategic processes is known as problem-solving skills. Polya (1957) emphasized the importance of understanding the problem, developing an action plan, implementing it, and evaluating the results as part of effective problem-solving. Senior secondary curricula, particularly in mathematics and science, require strong problem-solving skills that contribute to academic success by strengthening reasoning, analytical thinking, and decision-making (Jonassen, 2011). These skills are crucial for successful high school students. Hence, problem-solving abilities are a strong indicator of academic success.

Measurable learning outcomes, whether through grades, test scores or standardized assessments are considered academic achievement. Cognitive factors, motivation, emotional regulation and environmental factors influence it (Singh et al, 2016). By examining how anxiety, metacognition, resilience, and problem-solving are interdependent and impact their performance, student achievement can be understood in various ways.

Conceptual & Theoretical Framework

Various psychological and educational theories are utilized to conceptualize the relationship between anxiety, metacognition (promoting self-control), and resilience in decision-making and problem-solving skills among senior secondary school students. According to Sarmanson's 1988 study, the Cognitive Interference Theory proposes that anxiety disrupts cognitive processing by diverting attention from academic tasks and thereby diminishing performance. This theoretical perspective suggests that higher levels of anxiety are more likely to be a cause of poor academic performance. Self-regulation, planning and monitoring are said to increase the efficiency of learning according to the Metacognitive Theory (Flavell, 1979). Students who possess better metacognition are more likely to excel in academic tasks, which is a direct predictor of higher achievement.

According to Resilience Theory, the framework considers resilience as a dynamic process that allows individuals to adjust and thrive in spite of challenges or stress (Masten, 2014). Stronger students are more likely to cope with academic stressors, as per this theory. The Problem-Solving Model by Polya (1957) considers problem-solving as a necessary

cognitive activity for learning. The ability of students to solve academic challenges in a strategic manner enhances their achievement outcomes.

Anxiety is a potential barrier that can be overcome by an integrative conceptual model, which relies on metacognition, resilience, and problem-solving as key factors in achieving academic success. This model provides a comprehensive approach to studying the cognitive and emotional components of achievement in Indian schooling environments that are under intense pressure.

Research objectives

1. To study how anxiety affects the senior secondary school.
2. To scrutinize the impact of metacognition on students' learning....
3. To gauge the extent of resilience in predicting academic performance.
4. To measure how well problem-solving skills affect academic performance.
5. To establish the combined predictive power of all four variables on academic performance.

RESEARCH METHODOLOGY

The approach used is based on secondary data, with extensive use of previously published scholarly literature, policy documents, national educational databases, and psychological scale manuals that cover topics such as anxiety, metacognition, resilience, problem-solving skills, and academic achievement. The secondary data was sourced from peer-reviewed journals, government reports like NCERT and MHRD publications (for academic purposes only), international educational databases such as ERIC, JSTOR, and Google Scholar. In order to identify trends, patterns, and theoretical linkages among the selected variables from Indian and global sources, the study draws on empirical findings. They assessed the credibility, relevance, and methodological rigor of existing studies through a systematic review process. It allowed for the amalgamation of different viewpoints, comprehensive comprehension of predictors that determine academic performance and a conceptual synthesis without the necessity of primary field research. Studies that aim to consolidate

existing knowledge and gain insights for educational practice or future research can make use of secondary data methodology.

REVIEW OF LITERATURE

The study carried out by Parveen (2019) revealed that in senior secondary students, the level of test anxiety was positively associated with their academic performance, with higher test anxious scores being more likely to result in lower scores. It is evident from this research that Indian schools must implement measures to alleviate anxiety. (Parveen, 2019).

Taruna Malhotro (2014) has found that 80% of senior secondary students experience moderate to high exam anxiety, which is connected to lower academic performance; she suggested that anxiety can be mitigated by time-management strategies and school-based counseling to reduce the impact of anxiety.

Vani (2016) established that the evidence supports the notion that metacognitive awareness is different among high, average, and low achievers, indicating that students with better metaphysical knowledge or regulation achieved higher examination marks. This supported the idea of metakognition as a significant predictor of academic success.

A research study on metacognition in college/senior students (IJARSCT, 2021) revealed strong connections between using metacratic strategies (planning, monitoring) and academic performance, indicating that training in metacritic techniques could enhance performance in senior secondary.

Padmashri Rao (2018) observed that the capacity of students to withstand academic pressure is positively linked to their educational success; students who were resilient demonstrated greater persistence and improved their ability to recover from low test scores. The research highlights the significance of building resilience through counseling programmes. (Rao, 2018)

Singh (1924) examined methods for enhancing resilience among Indian adolescents and observed connections between resilience and enhanced school engagement and achievement, particularly where family and school support was present.

A study conducted in a large sample of senior secondary students found significant positive correlations between problem-solving skills and academic achievement, with

students who scored higher on structured problem solving inventories also scoring higher in subject examinations. (Rather, 2025)

A study conducted by AJASRA revealed that senior secondary students who demonstrated better problem-solving abilities than others, particularly in mathematics and science, had more successful outcomes.

In several Indian descriptive studies conducted between 2020 and 2025, anxiety is consistently found to decrease the effectiveness of working memory and exams, while metacognition (e.g, resilience) and problem solving reduce stress and jointly predict better academic outcomes in senior secondary samples.

Recent research in the region indicates that anxiety is a negative predictor of achievement, while metacognition, resilience and problem-solving have positive impacts and may moderate anxiety's impact, supporting multi-component school interventions (Integrative studies, 2024–2025).

POTENTIAL CONSEQUENCES FOR THE ANOMIE OF JUNIOR SECONDARY STUDENTS

Analyzing Anxiety (General, Academic, Test Anger)

The underlying construct of anxiety is multifaceted, encompassing both generalized physiological arousal and worry as well as specific situations such as academic and test anxiety. Test anxiety typically involves cognitive worry combined with somatic symptoms and avoidance of tasks that interferes with exam preparation and performance (Spielberger, 2010). Educational research highlights the importance of the cognitive component (worry) as it consumes working-memory capacity required for complex problem-solving, leading to the conceptualization of test anxiety as affect (fear) and a cognitive interference process that undermines performance on high-stakes tasks.

High occurrence of anxiety in Indian Senior Secondary Schools

Epidemiological and school-based surveys in India exhibit considerable variation among adolescent anxiety estimates, with varying single-study values based on tool and context. However, recent school samples indicate low or moderate levels of exam anxiety, as demonstrated by examining 679 school adolescents in Delhi who underwent standardized

testing. Additionally, multiple focused studies conducted among senior-secondary cohorts revealed variable distribution patterns due to the presence/frequency of low/medium/high exam anxious (many localized reports reported 10–50% between them) (Sonam et al., 2025).

Table 1 — Selected prevalence / level data for anxiety among Indian senior-secondary / adolescent school samples

Study (place, year)	Sample (n)	Measure / cut-off	Key statistic
Sonam et al., Delhi (2025)	679	PHQ-4 screening	Anxiety prevalence = **13.7%**.
IJRSS, Assam (West Karbi Anglong) (2025)	92 (sample)	Students Examination Anxiety Test (SEAT)	Distribution across levels (e.g., girls: 9.43% high; boys: 0% high; see source).

Research conducted previously on anxiety and academic performance across India and other countries

International rigorous reviews and meta-analyses reveal that test/anxiety are positively associated with academic performance, particularly when it is linked to complex, working-memory intensive tasks like math and problem solving. This pattern is also evident in Indian empirical studies, which show that higher test anxiety is connected to lower marks and greater avoidance of exams in senior secondary cohort members. The international theory and Indian evidence suggest that anxiety is not a minor factor but impedes achievement in rigorous secondary curricula (Caviola et al., 2022; Sonam et al., 2025).

The ways in which anxiety can impact academic performance

The Proteomics/Attentional Control theories suggest that cognitive worry consumes limited working-memory resources and redirects attention to threat-related thoughts, resulting in reduced processing efficiency and degrading performance on high-load academic tasks.

Furthermore, physiological arousal and avoidance behaviours contribute to this process, which also causes immediate impairment and longer-term declines through lack of practice or sleep. In summary, anxiety reduces both the cognitive resources for problem-solving and the behavioural routines that lead to learning gains (Eysenck & Calvo, 1992; Ng & Lee, 2015).

THE STUDY OF SENIOR SECONDARY SCHOOL STUDENTS INVOLVES BOTH SELF-REFERENTIAL LEARNING AND MEDITATION

Metacognition: Components and Strategies (Metaceutical Knowledge & Strategies)

A common way to divide metacognition, or thinking about it, is as meta-knowledge (awareness of task demands, personal strategies, and cognition) but also met coercive regulation (planning, monitoring. The implementation of a two-component structure in the Floreman framework is essential for senior secondary students, who must devise study plans, monitor the understanding of abstract concepts, and assess the impact of revision (Jaleel & Premachandran, 2016).

Metacognition important for Academic Settings

According to empirical and intervention research, the use of metacognitive strategy in instruction (self-questioning, planning, self-testing) enhances learning efficiency and transfer across subjects. Additionally, metaconcept is a significant non-causal predictor of achievement beyond raw intellectual ability for adolescents in senior secondary streams, supporting autonomous learning (Dignath & Büttner, 2008; Jaleel, 2016).

Empirical evidence from adolescence and secondary education shows that Metacognition is positively associated with Academic Achievement.

Studies conducted in Indian schools have consistently demonstrated positive associations between metacognitive awareness/use and higher examination scores, with research indicating that students with higher metacognostication skills perform better than those of their peers in both subject tests and board exams. Metacognitive instruction in classes can result in measurable gains for senior secondary learners, as suggested by policy. (Das et al., 2024; Jaleel & Premachandran, 2016).

Table 2 — Selected metacognitive awareness distribution in Indian secondary samples

Study	Sample (n)	Key finding
Das et al., Library Progress Intern. (2024)	120	**44.2%** average metacognitive awareness; **39.2%** high awareness (private > government; urban > rural). https://bpasjournals.com/library-science/index.php/journal/article/download/2166/1914/5319.
Jaleel & Premachandran (Universal J Educ Res, 2016)	180	No large gender/locality differences; metacognitive regulation predicted better performance in the sample. https://files.eric.ed.gov/fulltext/EJ1086242.pdf.

The importance of Metacognition for Indian School Students.

As Indian senior secondary curricula emphasize self-directed study and abstract problem solving, especially in science and mathematics, students with strong metacognitive regulation can plan revision for higher board and entrance scores by practicing practices like self correction (Jaleel, 2016; Das et al., 2024).

IN THE CONTEXT OF AN EQUILIBRIUM CONDITION, SILENCING IS A PHYSIOLOGICAL SOURCE

Resilience: Definitions, Dimensions (Emotional, Cognitive, Social)

Adolescents' resilience is defined by their ability to regulate stress, use cognitive flexibility to reframe challenges, and access to social support (family/school relationships) that prevent negative experiences. Multidimensional resilience, which manifests in persistence, help-seeking, and adaptive coping, is made possible by measures like CYRM-12 that operationalize the concept of resilience as an interaction between individual skills, relationships, contextual resources (Banerjee et al., 2018).

The challenges and safeguarding of adolescent resilience in school and education are significant.

Adolescents in the senior secondary stage face challenging academic demands and performance expectations; resilience acts as a protective factor by helping them recover from subpar test scores, preserving effort while employing problem-solving techniques that promote lasting learning. These characteristics are linked to sustained academic engagement and improved results over time. The use of school-based programs and parental time allocation has been associated with higher resilience scores in Indian samples. (Banerjee et al., 2018).

Research on the Impact of resilience on academic performance and personal well-being

A study conducted in Kolkata and other Indian schools found that less than 7.7% of adolescents met the CYRM-12 threshold. Physical activity as well as family time were significant predictors of resilience, which are linked to self-rated school performance. (Banerjee et al., 2018; Cai et al., 2025).

The effects on Senior Secondary Students in India.

Practitioners and policy makers view resilience as a two-fold pathway that includes improving students' ability to cope with exam stress and reducing anxiety related performance loss, as well as supporting continued engagement that leads to improved achievement through resilience enhancement (Banerjee et al., 2018; Cai et al., 2025).

THE ROLE OF PROBLEM-SOLVING SKILLS IN ACADEMIC SUCCESS ARE CRUCIAL

Cognitive, Metacognitive, Social) - Define Problem-Solving Skills.

Problem-solving skills are made up of cognitive operations, metacognitive activities, and social competencies. The multi-component view explains that problem solving is not only about applying domain knowledge, but also about organizing and managing strategic planning, reflection, and social negotiation when collaborative tasks are assigned (Meisner, 2016).

How important is education and problem-solving in senior secondary school

Students in their senior-secondary years are confronted with challenging, abstract problems, particularly in mathematics, physics/chemistry, and economics, which require strategic planning, conceptual understanding, or reflective thinking to succeed. As a result, education that fosters problem-solving skills through worked examples and modeling metacognitive strategies and scaffolded complex tasks has been found to improve deep learning and prepare students for high-profile board exams and entrance tests. At the senior-secondary level, problem-solving skills are a crucial factor to consider in achieving academic success, as they are highly valued by students' curricular demands (Gupta & Pasrija, 2016).

According to research evidence, problem-solving abilities are predictive of academic success

Many Indian empirical studies indicate moderate to strong positive correlations between students' problem-solving ability and academic performance. In one study, Gurudeva (2019) found that correlations up to r = 0.6454 is significant in government school substudents; an independent research site at IJTSRD reported p = 0,5836 for secondary sample (moderate positive correlation); and various regional studies indicate that approximately 60–70% of students are in average problem-solving categories, while those in the high problem solving band have higher mean grades (see Table 1). A recent study by Pearson validated this finding. The correlation between problem-solving ability and subject-specific outcomes in Indian senior-secondary contexts is consistent and positive, indicating that these outcomes are highly correlated. (Gurudeva, 2019).

Table 3 — Selected empirical correlations between problem-solving ability and academic achievement (Indian studies)

Study (year)	Sample (n)	Reported correlation (r)
Gurudeva (2019) — IJREISS	(reported subsamples)	**r=0.6454** (government schools).
IJTSRD (2019)	— (secondary students)	**r = 0.5836**.

Pathak (2015)	n = 50 (pupil teachers)	**r = 0.727** ($p < .01$).

Contextual Relevance in Indian Schools.

The classrooms in Indian senior-secondary institutions vary depending on the type, medium, and location of the school; research indicates that urban and private schools tend to have more problem-solving aptitude than their rural or government counterparts, reflecting differences in pedagogical emphasis and access to enriched learning environments. Several regional surveys indicated that approximately 65.5% of higher-school students possessed an average level of problem-solving skills, while only a small percentage of students were in the 'high' band. The findings suggest that high-performing students in this band have exhibited better math abilities, indicating naivety in Indian schools and advocating for targeted interventions (ResearchGate problem-solving study, 2017).

USING THE INTERNAL MODEL'S FEATURES, METHODS OF INQUIRY AND REFLECTION, AND SOLUTIONS TO SOLVE PROBLEMS, THE OUTCOME IS LIKELY TO BE IN LINE WITH DOMESTIC SUCCESS.

Reason for incorporating All Four Predictors

In both theoretical and applied contexts, anxiety is a representation of the explanatory domains concerned, along with metacognition as coping mechanism, resilience as being an attribute of resilience, and problem-solving as reflecting competencies. A multidimensional model that incorporates predictors and measures cognitive ability, metacognition, resilience, and problem-solving gives more predictive power for academic achievement than any single variable (International Publs, 2025).

Variables in Relation to each other (direct effects, mediations, interactions)

Mechanistic and empirical evidence indicate a plausible pattern where metacognition, resilience, and problem-solving are positively associated with achievement, while anxiety is negatively associated. Path analysis or SEM is the recommended method for testing layered relationships in school samples, which are supported by empirical studies using mediation models and SAM. (Owens, 2008; Prakoso, 2025).

The suggested conceptual/analytical framework (Graphical Model)

The outcome of Academic Achievement, Anxiety as a negative predictor, and Metacognition, Resilience, or Problem-Solving as positive predictors are all part of the practical conceptual framework for empirical testing. Within the model, there exist alternative paths of achieving goals (e.g, Metacognition, Problem-Solving d-signs x Achievement) and alternative ways (Resilience an anxiety imposed difficulty score achiev-max achievement). For analysis, the most suitable tests for this model are those using hierarchical multiple regression to evaluate incremental variance given by each predictor set as well as confirmatory structural equation modelling (SEM) to estimate direct, indirect and interaction effects all at once. Multicollinearity diagnostics, bootstrapped mediation tests (bias-corrected CI), and multi-group SEM for key subgroups (gender, school type) are among the suggested statistical checks. An integrative approach to analysis provides theoretical clarity and practical guidance for interventions such as teaching metacognitive strategies, resilience training, and problem-solving pedagogy to alleviate test anxiety (International Publs; Owens, 2008).

Table 4 — Distribution of Problem-Solving Ability levels (selected Indian studies)

Study	Sample (n)	% High	% Average	% Low
ResearchGate study (higher secondary)	—	~? (small)	**65.5%** average	remainder low/high.
Rather (Gwalior, 2025)	500	High band: (reported smaller proportion)	Average/moderate: ~16% males/14% females	Below average: males 6% / females 22% (gender differences reported).

RECOMMENDATIONS

In order to put the study's results into practice, I present the following ten actions for schools, teacher-educators and policymakers:

1. Integrate explicit metacognitive strategy instruction (self-monitoring, planning, self-testing) into senior-secondary curricula.
2. Embed problem-solving pedagogy (worked examples, scaffolded complex tasks) across STEM and humanities subjects.
3. Implement universal Social and Emotional Learning (SEL) modules by trained teachers that include anxiety-management, resilience, and coping skills;
4. Establish school counselling teams with not less than one trained counsellor to run small-group cognitive-behavioural and test-anxiety workshops in larger schools;
5. Provide teacher professional development on recognizing and reducing test anxiety and on teaching metacognition/problem-solving;
6. Adopt periodic, low-stakes formative assessments that will not only reduce high-stakes pressure but also improve retrieval practice; (7) design resilience-building activities (peer support programmes, family engagement, extra-curricular physical activity) to reinforce adaptive coping;
7. Collect routine, disaggregated data on student well-being and achievement to monitor at-risk cohorts and assess interventions;
8. Provide targeted remedial programs for students with low scores on problem-solving and metacognitive inventories; and
9. Align state and school policies (including NEP-2020 priorities) to fund and monitor SEL, mental-health and metacognition interventions.

These suggestions are based on considerable meta-analyses that demonstrate strong impacts of SELF and self-management teaching on both emotional-social aspects and academic success, as well as on test-anxiety studies that indicate the positive effects of structured anxiety-reduction and formative assessment methods on student performance.

CONCLUSION

A contemporary synthesis of literature on anxiety, metacognition (hypocritical awareness), resilience, and problem-solving skills suggests that senior-secondary academic achievement is best understood as the result of interacting affective, regulatory, or cognitive

processes. Test-specific worry and anxiety are correlated with poor performance on high-load tasks, as they consume limited working memory resources and encourage avoidance and suboptimal study behaviors. Meta-analytical and review evidence suggests that test anxiety is positively and reliably replicable to achieve various achievement outcomes. In comparison, interventions that teach planning, monitoring, and evaluation offer direct, teachable pathways to improved performance through metacognition and problem-solving skills, resulting in moderate to large gains in strategy use and measurable achievement effects in secondary contexts. Through resilience, one can act as a protective mechanism that fosters persistence through adaptive management and engagement in the face of setbacks, which preserve learning opportunities and mitigate the negative impacts of anxiety. By merging the four predictors into a unified analytic model, they are responsible for accounting for both immediate cognitive limitations (anxiety) and the regulatory and skill-based mechanisms that drive long-term academic development (metacognition, resilience, problem-solving).

In Indian senior secondary students, the implications are both practical and policy-relevant. NEP-2020's emphasis on holistic education and wellbeing foster a favorable policy environment for the implementation of self-directed learning (SEL), metacognitive instruction, and problem-solving pedagogy at scale; meta-analytic evidence supports universal school programmes that achieve significant achievement gains (11 percentile points) and enhance emotional regulation and resilience. This leads to evidence that supports a multi-pronged school approach that includes: frequent formative assessment, teaching metacognitive and problem-solving strategies in subject instruction, and supporting schoolwide resilience. Along with systematic monitoring of results, using such measures would also help adolescents improve their mental health outcomes and longer-term educational journeys.

Limitations of the Study

The use of secondary data synthesis limits the findings to the scope, quality, and heterogeneity of the original studies. This is due to different instrument types, cut-offs, sample frames, publications bias, which limit the accuracy of causal inference and effect sizes. However, this study was not completely accurate because of these factors. Residual confounding can occur due to the absence of uniform covariates, such as socioeconomic status and school resources, which are not collected by secondary synthesis. The absence of

language and regional publications (such as some high-quality local studies that are not indexed globally) can lead to biased conclusions in more widely published contexts.

Suggestions for Future Research

Research in India should focus on multi-site longitudinal and mixed-methods studies that employ validated tools for anxiety, metacognition, resilience or problem solving to enable causal modelling. Cluster-RCTs that test both metacognitive training and SEL programming with problem-solving curricula would reveal synergistic and additive effects on the outcome of board-exam tests. SEM with bootstrapped mediation should be used to investigate moderators (gender, school type, socioeconomic status) and mediators (working memory, self-efficacy) among researchers. The possibility of utilizing secondary data through education administrative information or health status surveys is promising, but it demands careful verification.

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