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Impact of Cognitive Ability on Academic Achievement of Adolescent Students

V. Rose[1], Dr. V.Vasudevan[2]
[1]PhD Research Scholar, Department of Educational Psychology,
Tamilnadu Teachers Education University, Karapakkam, Chennai, India.
[2]Research Supervisor, Asst. Professor and Head,
Department of Educational Psychology, Tamilnadu Teachers Education University, Karapakkam, Chennai, India.

INTRODUCTION

Education serves as a fundamental pillar for both societal advancement and personal development, playing a vital role in fostering individual growth, economic well-being, and social progress. At the higher secondary level, student performance is a pivotal benchmark that significantly impacts their future academic and career paths. The drive for academic excellence has become a major focus, with educators, policymakers, and researchers striving to understand the intricate factors that affect students' academic success.

In India's ever-evolving educational system, Tamil Nadu stands out for its strong emphasis on learning and its well-established network of higher secondary schools. Among its many districts, Thirupathur serves as a reflection of the broader educational strengths and struggles seen across the state. This district, situated in southern Tamil Nadu, presents a valuable case for examining student and teacher experiences. It mirrors the diverse academic conditions present in both urban and rural areas.

Analyzing what drives or limits student achievement here offers key insights into regional education trends. The district's educational outcomes can influence not just academic success but also broader socioeconomic progress. Understanding these factors helps educators tailor support systems for learners. It also sheds light on policy effectiveness at the local level. Such exploration is essential for promoting inclusive and quality education in the region. Ultimately, it holds significance for shaping the future of Thirupathur's youth and community development.

Educational researchers have long focused on cognitive ability as a key factor influencing academic success. This ability includes various mental functions such as memory, attention, reasoning, and problem-solving, all of which are essential to effective learning. Understanding how cognitive skills impact academic performance is crucial for educators and policymakers, as it can guide the design of targeted interventions and curriculum improvements aimed at boosting student achievement.

This study investigates the complex link between cognitive ability and academic performance among adolescent students in Thirupathur district of Tamil Nadu. It seeks to understand how cognitive skills influence students' academic outcomes and how additional factors—such as socio-economic background, school facilities, and teaching approaches—interact with these cognitive elements. Through this analysis, the research aims to offer meaningful insights that can help educators and policymakers develop informed, data-driven strategies to support student achievement in the region.

The following sections present a review of existing literature, outline the research methodology, share the study's findings, and discuss their broader significance. This inquiry aspires not only to deepen our understanding of education in Thirupathur but also to contribute to the wider conversations on educational psychology and policy-making in the Indian context.

Background of the study

India, with its rich cultural heritage and diverse populace, has always placed a strong emphasis on

education as a means of personal and societal advancement. The Indian education system is a complex mosaic, with each state and district having its unique challenges and opportunities. Tamil Nadu, situated in the southern part of India, has been a forerunner in the field of education, consistently striving to provide quality education to its residents.

The state of Tamil Nadu boasts a well-structured education system, beginning from primary schooling and extending to higher secondary education. Higher secondary education, encompassing classes 11 and 12, is a pivotal phase in the academic journey of Indian students. During this phase, students not only prepare for crucial board examinations but also make critical decisions regarding their future academic and career paths.

In the state of Tamil Nadu, Thirupathur district holds a distinctive position within the educational sphere. Characterized by its diverse population and varying socio-economic conditions, Thirupathur offers a compelling context for exploring the factors that impact academic performance among adolescent learners. Similar to many regions across the nation, this district contends with issues such as limited educational access, disparities in teaching quality, and socio-economic inequalities.

Academic performance, a key indicator of educational success, is shaped by numerous influences. Among these are pedagogical strategies, curriculum design, and the availability of educational resources. However, a critical and often foundational determinant is students' cognitive abilities. These abilities include a range of mental functions—such as memory, analytical thinking, and problem-solving—which are essential for effective learning and overall academic achievement.

Studies have consistently demonstrated that cognitive ability significantly influences a student's capacity to understand, retain, and utilize information. Nevertheless, the connection between cognitive ability and academic performance is multifaceted and shaped by a range of contextual elements, such as socio-economic background, family involvement, and the standard of instruction.

Gaining a deeper understanding of this complex relationship is vital for educators, administrators, and policymakers in Thirupathur district and similar regions. It can inform the creation of focused support systems for students with diverse cognitive abilities, thereby improving their academic outcomes and future prospects.

This research paper seeks to enrich the current literature by exploring the association between cognitive abilities and academic success among higher secondary students in Thirupathur district. By analyzing the distinct characteristics and challenges of the district within the broader Indian educational framework, the study aims to offer meaningful insights to shape educational policy, refine curricula, and adapt teaching approaches to better meet the needs of local learners.

In the sections that follow, we outline the research methodology, share key findings, and provide an in-depth analysis of their implications. Through this study, we aim to deliver a valuable reference for those committed to advancing adolescent education in Thirupathur district, Tamil Nadu.

Objectives of the Research

The primary aim of this research is to investigate and understand the Impact of cognitive ability on academic achievement of Adolescent students in Thirupathur District, Tamil Nadu. To achieve this overarching goal, the following specific objectives have been formulated:

1. **Assess Cognitive ability**: To assess the Cognitive ability of Adolescent students in Thirupathur District using standardized cognitive assessment tools. This objective involves measuring various cognitive domains, including memory, attention, problem-solving, and critical thinking.
2. **Evaluate Academic Achievement**: To evaluate the academic achievement of Adolescent students in Thirupathur District, considering their performance in key subjects, such as mathematics, science,

language, and social studies. This objective includes analyzing academic records and examination results.

3. **Examine the Relationship**: To examine the correlation between Cognitive ability and academic achievement among the students. This objective involves statistical analyses to determine the strength and direction of the relationship between Cognitive ability and academic performance.
4. **Identify Moderating Factors**: To identify potential moderating factors that may influence the relationship between Cognitive ability and academic achievement. These factors could include socio-economic status, parental involvement, school infrastructure, and teaching methods.
5. **Explore Gender and Regional Differences**: To explore gender and regional differences in Cognitive ability and academic achievement within Thirupathur District. This objective aims to identify any disparities that may exist and their underlying causes.
6. **Provide Recommendations**: To provide evidence-based recommendations for educators, policymakers, and other stakeholders in Thirupathur District. These recommendations will be grounded in the research findings and aim to improve educational outcomes by tailoring interventions to the specific needs of the students in the district.
7. **Contribute to Educational Discourse**: To contribute to the broader educational discourse in India by offering insights into the interplay between cognitive abilities and academic achievement. This objective seeks to add to the body of knowledge that informs educational policy and practice in the country.

By pursuing these objectives, this research endeavors to offer a comprehensive understanding of how Cognitive ability relate to academic performance among Adolescent students in Thirupathur District. Moreover, it aspires to provide practical guidance for educational stakeholders in the district and contribute to the enhancement of educational outcomes and opportunities for its students.

Define the key terms in the title of the research:

Cognitive ability: Cognitive ability refer to a set of mental processes and skills that encompass various aspects of thinking, problem-solving, and learning. These abilities include memory, attention, reasoning, critical thinking, and information processing. In the context of your research, Cognitive ability will be assessed to understand how they relate to academic achievement.

Academic Achievement: Academic achievement signifies student's performance and success in an educational setting, typically measured through assessments, examinations, and academic records. It encompasses the level of competence and accomplishment a student demonstrates in subjects such as mathematics, science, language, and social studies during their higher secondary education.

Adolescent Students: Adolescent students taken for this study who are in the age group of 16 to 18 and are enrolled in the final two years of secondary education in India. This phase of education is a critical juncture that prepares students for higher education or vocational training and plays a significant role in shaping their academic and career paths.

Thirupathur District: Thirupathur District is a specific administrative region within the state of Tamil Nadu, India. It has its unique demographic, socio-economic, and educational characteristics, making it an interesting and relevant context for your research.

Tamil Nadu: Tamil Nadu is a state in southern India known for its strong emphasis on education and a well-structured education system. It provides the broader geographical context within which your research is conducted.

REVIEW OF RELATED LITERATURE

Zhou, W., Xie, et al.. (2025). Peer effects among friends on students' cognitive abilities: An analysis based on emotional distance. In contemporary society, students' cognitive abilities are crucial for the accumulation of human capital. Consequently, significant concern has been expressed regarding the impact of peer effects among friends on students' cognitive abilities. Based on the "China Education Tracking Survey" data, we discuss peer effects among friends on students' cognitive abilities from the perspective of Emotional Distance Analysis. Our study shows that: (1) Students' average scores could be actively affected by the increase in the number of friends with good grades. (2) Peer effects among friends

are in accord with different students. Such effects are more easily exerted among female students and those with better average grades or local household registration. (3) The mechanism study found that the conduction effect of peer effects among friends mainly relies on two paths. One is manifested as the "compliance effect". In other words, to align with their friends, students increase their study time, raise their educational aspirations, and minimize instances of skipping classes and absenteeism. The other channel is the "anchoring effect," which involves raising parents' reference standards, leading them to devote more time and energy to their children's learning. Therefore, the rational use of social interaction with friends is a vital approach to enhancing students' cognitive abilities.

Arul Magi Raj & Dr. S. Komalavalli (2023): An Analysis On Cognitive Ability And Academic Achievement of High School Students: The main purpose of this paper is to assess the cognitive ability of high school students and its relationship with academic achievement. Sample of the study comprises of 250 high school students in Chennai District. Normative survey method was adopted for data collection. Stratified Random sampling method was used to select the sample of the study. Cognitive Ability Test was developed and standardized by the investigator. 't' test and Pearson product moment correlation was used to analyse the collected data. Results revealed that there is significant relationship between cognitive ability and academic achievement of high school students. Also, it was found that there is significant difference between boys and girls in cognitive ability and academic achievement. But there was no significant difference found in cognitive ability and academic achievement with respect to type of family.

Achor, E. E., & Ngbea, P. M. (2022). Implications of cognitive abilities in students' performance in physics using group dynamics and visual-clue strategies. Journal of Research in Instructional, 2(1), 33–46. https://doi.org/ (e-ISSN: 2776-222X)

Nwanze Azubuike et al..(2021) "The research investigated the influence of cognitive ability on the academic performance of secondary school science students within the Onitsha Education Zone. The findings demonstrated that the dominant cognitive ability among science students was field- dependence, and notably, students with field-independent cognitive tendencies achieved significantly higher scores compared to their field-dependent counterparts. Additionally, the study highlighted the substantial impact of cognitive ability as a determinant of science achievement among secondary school students."

BernardAetal..(2019)."The study investigated the impact of cognitive ability on students' academic performance and retentioninphysicsattheseniorsecondaryschoollevelwithintheGwer-WestLocal Government Area of Benue State, Nigeria. The findings demonstrated that students with field-independent cognitive characteristics outperformed their field-dependent counterparts in physics. Moreover, field-independent students exhibited a superior capacity for retaining physics knowledge compared to field-dependent students. Additionally, the research revealed that male students achieved higher scores than their female counterparts in the field-dependent aspect of physics."

Balasubramanian and Sivakumar (2018) "The study unveiled the influence of cognitive ability on the academic attainment of Adolescent students. The findings indicated that there was no noteworthy distinction in cognitive ability between male and female Adolescent students. However, a significant disparity emerged between male and female higher secondary students in their academic performance. Furthermore, the research uncovered a substantial correlation between cognitive ability and the academic achievement of Adolescent students."

TITLE OF THE STUDY

The title of the present study is "Impact of Cognitive Ability on Academic Achievementof Adolescent Students"

Population: the population would be all the Adolescent students in Thirupathur District, irrespective of their specific schools, backgrounds, or other characteristics. This includes all eligible students within the district.

Sample: Sample For this present study 300 Adolescent students from government, and private schools of Thirupathur District were selected as the sample for the study. Simple random Sampling technique was

used for collect the sample

Tool Used: Cognitive Ability Inventory (CSI): The investigator used Cognitive Ability Inventory (CSI) constructed and standardized by Praveen Kumar Jha (2001). The Cognitive Ability Inventory consists of 40 statements and its dimensions viz., systematic ability and intuitive ability

TABLE1		
Distribution of participating students.		
Stream	Number of students	
	Male	Female
Arts Stream	60	60
Science Stream	50	50
Vocational Stream	45	35
Total	155	145

Hypotheses of the Study

1. There is no significant difference in cognitive ability of Adolescent students with respect to gender, type of school and locality.
2. There is no significant difference in academic achievement of Adolescent students with respect to gender, type of school and locality.
3. There is no significant relationship between Cognitive ability and academic achievement of Adolescent students.

Research Design

"The present study is classified as a descriptive study, involving the random selection of 300 students exclusively from higher secondary schools in Thirupathur District. Stratification was conducted based on gender, locality, and school type. Academic achievement scores from the previous exam were employed as the primary measure of academic performance. To assess the cognitive ability of students, the Cognitive Style Inventory developed by Jha (2001) was employed. Data analysis was conducted utilizing statistical methods, including descriptive statistics such as the mean and standard deviation (SD). Additionally, 't-tests' were employed to determine the significance of differences across various groups. 'r' values were calculated to explore the relationship between cognitive abilities and academic achievement among Adolescent students."

TABLE 2 Level of Cognitive Ability of Adolescent Students Dimensions

Dimensions	**Total sample**	**Low**		**Moderate**		**high**	
		N	%	N	%	N	%
Systematic ability	300	76	25.33	154	51.33	70	23.33
Intuitive ability		69	23.00	162	54.00	69	23.00
Cognitive ability		73	24.17	158	52.67	70	23.17

It is inferred from the above table shows that 25.3% of the adolescent students have low, 51.3% of them have moderate and 23.3 % of them have high level of systematic ability. It is inferred that 23% of the adolescent students have low, 54% of them have moderate and 23% of them have high level of intuitive ability. 24.17%, 52.67%, 23.17 % of Adolescent students have low, moderate and high level Cognitive ability respectively. From the above table shown in overall, the Adolescent students have moderate level of cognitive ability.

TABLE 3 Significant difference between male and female higher secondary school students in their Cognitive ability

Dimensions	**Total sample**	**Male(155)**		**Female(145)**		**t value**	**Sig. Level**
		Mean	S.D	Mean	S.D		
Systematic ability	300	11.25	1.236	11.58	1.325	0.125	NS
Intuitive ability		11.87	1.251	11.25	1.245	0.174	NS
Cognitive ability		129.21	3.124	129.25	2.098	0.041	S

TABLE 4 Academic Achievement of Adolescent students with Respect to Gender, Type of School and Locale

Variable	Category	N	Mean	S.D	t test	Sig. level
Gender	Female	145	827.46	73.422	0.007	S
	Male	155	805.35	93.751		
Type of school	Government	180	786.27	69.959	0.921	NS
	Private	220	822.09	75.825		
Locality of school	Rural	160	813.51	78.315	0.635	NS
	Urban	140	820.75	92.956		

Correlations

		Cognitive ability	Academic Achievement
Cognitive ability	Pearson Correlation	1	.557**
	Sig.(2-tailed)		.000
	N	300	
Academic Achievement	Pearson Correlation	.557**	1
	Sig.(2-tailed)	.000	
	N	300	

**.Correlation is significant at the 0.01level (2-tailed).

The table shows that the Pearson Correlation value is 0.557 which is positive in nature. The Significant level is 0.000 which is highly significant at 0.01 level. So, it is inferred that there was a significant and positive relationship between cognitive ability and academic achievement among Adolescent students. If the Student has high Cognitive ability definitely his Academic Achievement level also will be high. So there is high impact of Cognitive ability on the academic achievement of Adolescent students.

Findings

1. **Cognitive Ability Level**: Adolescent students displayed a moderate level of cognitive ability.
2. **Gender and School Type**: The cognitive ability of adolescent students did not vary significantly based on gender or school type.
3. **Locality**: However, the cognitive ability of secondary school students showed a significant difference based on locality.
4. **Gender and Academic Achievement**: Academic achievement among female secondary school students was higher compared to their male counterparts.

5. **Cognitive Abilities and Academic Achievement**: Statistically significant mean differences were observed in academic achievement scores among Adolescent students with varying Cognitive ability. Students with an integrated style had the highest mean scores, followed by those with systematic, split, undifferentiated, and intuitive styles.
6. **Relationship between Cognitive Ability and Academic Achievement**: There was a significant and positive relationship between cognitive ability and academic achievement among secondary school students.

Educational Implications:
1. **Gender and School Type**: The study found no gender or school type-based differences in the Cognitive ability of Adolescent students. Thus, schools should ensure equal opportunities for all students in both curricular and co-curricular activities.
2. **Locality**: Differences in cognitive ability were observed based on locality. Therefore, schools should consider organizing activities like puzzle solving, reasoning classes, brain training games, and adapt teaching methods to students' abilities accordingly.
3. **Gender and Academic Achievement**: Female secondary school students outperformed male students in academic achievement. Schools should allocate teaching and learning resources, with a focus on male students, to enhance their academic success.
4. **Cognitive ability and Academic Achievement**: Academic achievement varied based on cognitive styles, with integrated style students performing the best, followed by systematic, split, undifferentiated, and intuitive style students. Teachers should prioritize students with lower academic achievement, utilizing diverse teaching materials and strategies, such as audio visual aids, charts, and real objects, to support their learning.
5. **Positive Relationship**: The research identified a positive and significant relationship between cognitive ability and academic achievement. Schools should consider providing cognitive training, reasoning classes, and quiz competitions to enhance students' Cognitive ability, ultimately improving their academic performance.

CONCLUSION

“This research highlights the impact of cognitive ability on the academic achievement of adolescent students. The results show that, on average, students demonstrate a moderate level of cognitive ability. Interestingly, neither gender nor the type of school significantly affected cognitive ability, indicating that cognitive potential is relatively uniform across different student groups. However, locality did show a significant impact, pointing to the importance of customizing educational strategies based on regional factors.

The study also found that female students generally performed better academically than their male peers. In addition, notable differences in academic achievement were linked to cognitive styles, with students who adopted an integrated style achieving the highest academic scores. This finding suggests that teaching methods should be adapted to suit various cognitive preferences.

Crucially, the study confirmed a strong positive correlation between cognitive ability and academic achievement underlining the value of cognitive development programs in education. Thus there is strong impact of Cognitive ability on academic achievement of Adolescent students.

Based on these insights, schools should implement a comprehensive approach that includes cognitive training, reasoning exercises, and quiz-based learning to strengthen students' cognitive skills—especially in underperforming areas. Furthermore, educational strategies should be inclusive and supportive of male students to close the achievement gap. By focusing on these areas, educational institutions can enhance student learning outcomes and promote holistic development.

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