



# **An Analysis On Cognitive Ability And Academic Achievement Of High School Students**

**Mr. J. Arul Magi Raj<sup>1\*</sup>, Dr. S. Komalavalli<sup>2</sup>**

<sup>1</sup>Ph.D. Research Scholar, Lady Willingdon Institute of Advanced Studies in Education, Chennai 600 005.

<sup>2</sup>Assistant Professor of Tamil Education, Lady Willingdon Institute of Advanced Studies in Education, Chennai 600 005.

## **APA Citation:**

Raj, J.A.M., Komalavalli, S., (2021). An Analysis On Cognitive Ability And Academic Achievement Of High School Students , *Journal of Language and Linguistic Studies*, 17(3), 2441-2445; 2021.

Submission Date: 13/10/2021

Acceptance Date: 27/12/2021

---

## **ABSTRACT**

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.

**Keywords:** Cognitive ability, Academic Achievement, Gender, Type of Family

---

## **Introduction**

Academic achievement has become a measure of dignity and success in every individual's life. One of the central purposes of intelligence testing is to predict educational achievement (Binet & Simon, 1916). Research has consistently shown that a positive correlation exists between cognitive abilities, measured by various psychometric tests and academic achievement.

Cognitive ability is the most significant predictor of academic achievement in many subjects, including mathematics (Taub, 2008). Individual differences in academic performance, on the other hand, have been related to IQ differences. Students with stronger mental abilities are more likely to excel in school. Schools can be incentivized to give cognitive training if academic accomplishment and cognitive abilities are interconnected (Padmini Pooja, 2017). But the concept of cognitive abilities is a complex one, since many different models of cognitive abilities have been proposed. These models may include the idea of a general cognitive ability and/or specific cognitive abilities (Sternberg, 1985).

Research findings supported that sustained and high - quality schooling and education directly affect on cognitive and academic achievement and may indirectly affect academic and cognitive development by triggering cognitive academic bi-directionality (Peng & Kievit 2020). Academic achievement of students can be enhanced by providing them problem solving situations in class, discussion on a topic, quiz competitions, brain storming activities etc. which will in turn help in developing their divergent thinking abilities. Sustain and high-quality of schooling improve the cognitive ability of students. Information processing speed is the

key predictor of fluid intelligence, working memory, and number sense, which in turn contribute to individual differences in academic success. Additionally, the specificity of the relationship between individual indicators of cognitive abilities and academic achievement at each level of schooling was revealed (Tikhomirova, 2020).

### **Review of Related Literature**

**Tikhomirova et al. (2020)** explored the relationship between cognitive abilities and academic achievement across schooling from the first to the eleventh grade was analyzed. Information processing speed, visuo-spatial working memory, number sense, and fluid intelligence were considered predictors of general academic achievement, which was derived from grades in mathematics, language, and biology. This cross-sectional study involved 1560 pupils who were in grades 1–11 at general education schools and were aged from 6.8 to 19.1 years (50.4% were boys). Information processing speed, visuo-spatial working memory, and number sense were measured using the Choice Reaction Time, Corsi Block-Tapping, and Number Sense computerized tests, respectively. Fluid intelligence was measured using the paper-and-pencil version of the Standard Progressive Matrices test. Correlation analysis and structural equation modeling were carried out. In this model, information processing speed was the key predictor of fluid intelligence, working memory, and number sense, which in turn contribute to individual differences in academic success.

**He et al. (2020)** examined how general cognitive abilities contribute to the academic achievement gains of both left behind children and children living with parents in poor areas of rural China. They measured the general cognitive ability of the 4,780 sample students using the Raven's Standard Progressive Matrices (Raven IQ) and assessed academic achievement using a curriculum-based mathematics exam. They found that IQ and left-behind status predicted achievement gains for the average student. Among low-IQ students, however, left-behind status does not correlate with a change in achievement, suggested that the migration of parents did not immediately translate into a loss of academic achievement for students with delays in their general cognitive ability.

**Rohde & Thompson (2007)** explained the variation in academic achievement with general cognitive ability and specific cognitive abilities. Grade point average, Wide Range Achievement Test III scores, and SAT scores represented academic achievement. The specific cognitive abilities of interest were: working memory, processing speed and spatial ability. General cognitive ability was measured with the Raven's Advanced Progressive Matrices and the Mill Hill Vocabulary Scales. When controlling for working memory, processing speed, and spatial ability, in a sample of 71 young adults (29 males), measures of general cognitive ability continued to add to the prediction of academic achievement, but none of the specific cognitive abilities accounted for additional variance in academic achievement after controlling for general cognitive ability. However, processing speed and spatial ability continued to account for a significant amount of additional variance when predicting scores for the mathematical portion of the SAT while holding general cognitive ability constant.

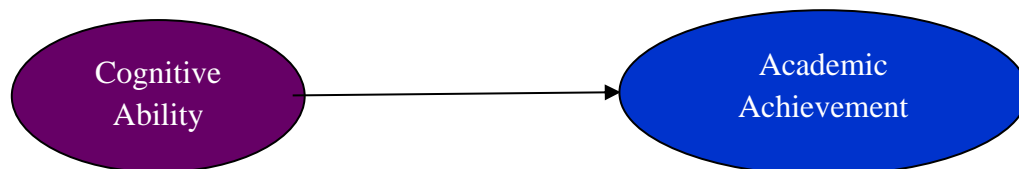
### **Need for the Study**

Cognitive ability occupies a pivotal position in Blooms Taxonomy as it is very imperative for the students to attain their achievement. Cognitive skills play a crucial role in every domain of life. It can be categorised as long-term memory, visual processing, processing speed, sustained attention, divided attention, working memory, logic and reasoning, selective attention, and auditory processing. These skills will help the students to recognise patterns, analyse and solve problems, understand and comprehend information, brainstorm effectively, and have focused attention.

As cognitive skills are very much necessary for developing higher order thinking skills, it is imperative to inculcate these skills among the high school students through the subjects they learn. Hence, considering the need of the hour, it is high time to study the relationship between cognitive ability and academic achievement of high school students.

### **Conceptual Framework of the Study**

Research has consistently shown that a positive correlation exists between cognitive abilities, measured by various psychometric tests and academic achievement. Cognitive ability is the most important predictor of academic achievement in many subjects, including mathematics (Taub et al., 2008). As the emphasis on the measures of student academic achievement increases educational researchers and practitioners are interested in identifying factors that demonstrate effectiveness in supporting student achievement. This research study measures the academic achievement and cognitive abilities of high school students in Chennai. The study will examine the differences in the cognitive abilities of students based on gender and type of family. The conceptual framework of the study is presented below.



### **Statement of the Problem**

The problem of the study can be stated as “**An Analysis on Cognitive Ability and Academic Achievement of High School Students.**”

### **Operational Definition of variables**

#### **Cognitive Ability**

Cognitive ability refers to the human brain’s ability to store memory, process and extraction of information, includes attention, memory and logical reasoning, and thinking transformation. It is a key factor that research can consistently predict Academic Achievement (Stadler et al., 2016).

In the present study, cognitive ability refers to how the high school students acquire knowledge, how they process information and how it is applied in problem solving.

#### **Academic Achievement**

Academic achievement is the level to which a student has attained either short- or long-term educational goals. Achievement may be measured through student’s scores in the test. In this study, high school student’s half-yearly achievement scores have been taken from the Mark Registers maintained by the class teacher.

#### **High School Students**

It refers to the students studying in standards VI, VII and VIII in high or higher secondary schools in Chennai, Tamil Nadu.

### **Hypotheses of the Study**

The following hypotheses were formulated to guide this study.

1. There is significant relationship between cognitive ability and academic achievement of high school students.
2. There is no significant difference between boys and girls in cognitive ability and academic achievement.
3. There is no significant difference between the students living in nuclear and joint family in cognitive ability and academic achievement.

### **Methodology**

Normative survey method is used for the study. The subjects for the study were 250 high school students in Chennai District. Random sampling technique was used for data collection.

### **Instrumentation**

The Cognitive Ability questionnaire was constructed and standardized by the investigator. It consists of 50 statements. The subjects were encouraged to respond spontaneously to each of the fifty items on a five point scale ranging from strongly disagree, disagree, neutral, agree and strongly agree. For a positive statement, the scores assigned were 1, 2, 3, 4 and 5 for strongly disagree, disagree, neutral, agree and strongly agree and for negative statements, the scores were reversed. The reliability of Cognitive Ability questionnaire is calculated using Cronbach's Alpha Co-efficient method. The reliability and the validity of the tool is 0.864 and 0.916 respectively which shows that the tool is highly reliable.

### Data Analysis and Interpretation

Data collected from the respondents were subjected to appropriate statistical analysis to draw up inferences from it. Pearson product moment correlation and 't' test was used for data analyses.

**Hypothesis 1:** There is significant relationship between cognitive ability and academic achievement of high school students.

**Table 1** Showing Pearson's Product Moment correlation co-efficient between Cognitive Ability and Academic Achievement

Variables	Cognitive Ability	Academic Achievement
Cognitive Ability	1	0.436**
Academic Achievement	x	1

Note: \*\*Correlation is significant at 0.01 level

From the above table value, it is inferred that there is significant and positive relationship between cognitive ability and academic achievement and is significant at 0.01 level.

**Hypothesis 2:** There is no significant difference between boys and girls in cognitive ability and academic achievement of high school students.

**Table 2** Significance of mean difference between boys and girls in Cognitive Ability and Academic Achievement

Variables	Gender				t value	P value
	Boys (N=110)		Girls (N=140)			
	Mean	SD	Mean	SD		
Cognitive Ability	147.56	22.687	143.97	21.760	2.479	0.009**
Academic Achievement	53.09	17.168	56.79	16.219	2.487	0.002**

Note: \*\* Significant at 0.01 level

It could be inferred from the table values that there is significant difference between boys and girls in cognitive ability and academic achievement of high school students which is significant at 0.01 level. Hence, the formulated hypothesis that there will be no significant difference between boys and girls in cognitive ability and academic achievement of high school students is rejected. From the mean scores, it is observed that boys have more cognitive ability than girls. But, in academic achievement it is observed that girl's performance is high when compared to boys. This may be due to the fact that girls tend to do better in exams as they spend more time in studying the subjects and put more hard work than boys.

**Hypothesis 3:** There is no significant difference between the students living in nuclear and joint family in cognitive ability and academic achievement among high school students.

**Table 3** Significance of mean difference between students in Cognitive Ability and Academic Achievement with respect to type of family

Variables	Type of Family				t value	P value
	Nuclear (N=141)		Joint (N=109)			
	Mean	SD	Mean	SD		
Cognitive Ability	145.59	22.721	145.34	20.687	0.152	0.879 <sup>NS</sup>
Academic Achievement	54.74	16.777	54.24	16.427	0.399	0.690 <sup>NS</sup>

Note: NS – Not Significant

It could be inferred from the table value that there exists no significant difference between the students living in nuclear and joint family in cognitive ability and academic achievement. It is evident that both students living in nuclear and joint family are similar in cognitive ability and academic achievement. This may be due to the fact that nowadays, children are very familiar in using technological devices for learning purpose. Hence they have high cognitive ability and high performance irrespective of type of family. Hence, the formulated hypothesis that there will be no significant difference between the students living in nuclear and joint family in cognitive ability and academic achievement is accepted.

## Conclusion

Research has shown strong positive relationship between cognitive ability and academic achievement of students. Although cognitive skills are seldom taught explicitly in schools, research indicates that schooling can promote cognitive skills. Traditional schooling emphasize on academic scores. Since, cognitive skills are a predictor of academic performance, schools that improve cognitive skills indirectly will improve academic performance also. On the other hand, teachers and parents play an important role in the development of cognitive skills among children. So, these skills can be developed by giving appropriate activities to the students according to their intelligence level and they can be motivated to participate in quizzes and competitions so as to improve their cognitive abilities.

## REFERENCES

- Hames. E and Baker. M. (2015). A Study of the Relationship between Learning Styles and Cognitive Abilities in Engineering Students. *European Journal of Engineering Education*, 40(2), 167-185.
- Ree, M. J., & Caretta, T. R. (1998). General cognitive ability and occupational performance. *International Review of Industrial and Organizational Psychology*, 13, 159–184.
- Rohde, T. E., & Thompson, L. A. (2007). Predicting academic achievement with cognitive ability. *Intelligence*, 35(1), 83–92. <https://doi.org/10.1016/j.intell.2006.05.004>
- Stadler M., Miriam A., Nicolas B., Samuel G. (2016). Choosing between what you want now and what you want most: self-control explains academic achievement beyond cognitive ability. *Individual Differences*, 94, 168–172.
- Taub, G. E., Keith, T. Z., Floyd, R. G., & McGrew, K. S. (2008). Effects of General and Broad Cognitive abilities on Mathematics Achievement. *School Psychology Quarterly*, 23, 187–198.
- Tikhomirova, Tatiana & Malykh, Artem & Malykh, Sergey. (2020). Predicting Academic Achievement with Cognitive Abilities: Cross-Sectional Study across School Education. *Behavioral Sciences*, 10, 158. 10.3390/bs10100158.
- Xinyue He , Huan Wang , Dimitris Friesen , Yaojiang Shi , Fang Chang & Han Liu (2020). Cognitive ability and academic performance among left-behind children: evidence from rural China, *Compare: A Journal of Comparative and International Education*. <https://doi.org/10.1080/03057925.2020.1848520>