Cognitive Problem-Solving Skill and Academic Achievement: A Study among Higher Secondary Students in Karaikal City

A. Stephen Harris Paul, Research Scholar, Department of Education, Tamil University, Tamil Nadu, India  
Dr.K.Chinnappan, Professor, Department of Education, Tamil University, Tamil Nadu, India

Abstract
Intelligence is the aggregate capacity of the individual to act purposefully, to think rationally and to deal effectively with his/her environment as the mental ability which helps the individual to think about minute, complex and abstract matters, to adjust with changing situations by solving various problems as quickly as possible. It is also helps to explain new situations with the help of previous experiences. Some psychologists have divided intelligence into subcategories. For example Howard Gardner maintained that is comprised of seven components which are musical, bodily kinesthetic, logical-mathematical linguistic, spatial, interpersonal, and intrapersonal. The term achievement has a broader meaning and refers to the acquisition of all the behavioural changes in the cognitive, affective and psychomotor domains. In the present study the term is used in a narrow sense referring to the outcomes which are the direct focus of classroom activity or board examination or scholastic achievement. The basic objectives of the present study is to identify the level of intelligence of science students in higher secondary, to find out the difference between level of intelligence of boys and girls students and to find out the relationship between Intelligence and academic achievement. The sample of the present study comprised of XII standard science students studying in Karaikal city. In the present study stratified random sampling technique was used to select the samples. A sample of 300 students were selected from five schools, out of which 150 boys and 150 girls. The result of the study reveals that majority (65%) of students have average level of Intelligence. It is also clear from the findings that there is a significant relationship between academic achievement and intelligence of secondary school students. In addition to the above we can also concluded that there is no significant difference between the Intelligence acquired by boys and girls science students in higher secondary.

Keywords: Intelligence, cognitive problem solving skill, Academic Achievement, Higher secondary students

Introduction
'Intelligence' is a general word that deals with cognitive problem-solving skill. It is a mental ability involved in reasoning, perceiving relationships and analogies, calculating, learning quickly...etc. Earlier it was believed that there was one underlying general factor at the intelligence base (the g-factor), but later psychologists maintained that it is more complicated by such a simplistic method. Here, intelligence is the aggregate capacity of the individual to act purposefully, to think rationally and to deal effectively with his/her environment as the mental ability which helps the individual to think about minute, complex and abstract matters, to adjust with changing situations by solving various problems as quickly as possible. It is also helps to explain new situations with the help of previous experiences. Some psychologists have divided intelligence into subcategories. For example Howard Gardner maintained that is comprised of seven components which are musical, bodily kinesthetic, logical-mathematical linguistic, spatial, interpersonal, and intrapersonal. Other definitions are: "Intelligence is what you do when you don't know what to do", "Intelligence is a hypothetical idea which we have defined as being reflected by certain types to behavior".

The term ‘achievement’ has a broader meaning and refers to the acquisition of all the behavioural changes in the cognitive, affective and psychomotor domains. In the present study the term is used in a narrow sense referring to the outcomes which are the direct focus of classroom activity or board examination or scholastic achievement. The term “Academic Achievement” denotes the knowledge attained or skills developed in school subjects, usually designated by the scores or marks assigned.

Intelligence and Academic Achievement:
Is intelligence related to academic achievement? Historically this question has been addressed by researchers. The relationship between measures of intelligence and achievement is significant to research, if there is a strong relationship between them. It might be deduced that the intelligence test has an important contribution in connection with other variables, for instance the curriculum, study program, the teacher, the characteristics of the school, and others in scholastic performance (Naglieri & Bornstein, 2003).

In current years, several researchers have shown more interest in the relationship between intelligence and academic achievement. Researchers mentioned that there are empirical evidence for a strong association between general cognitive ability and academic achievement,
there is still anywhere from 51% to 75% of the variance in academic achievement that is unaccounted for by measures of general cognitive ability alone (Rohde & Thompson, 2007). Additionally, understanding the nature of the relationship between general cognitive ability and academic achievement has widespread implications for both practice and theory (Rohde & Thompson, 2007). Academic achievement of students in high school strongly correlates (0.50 to 0.70) with intelligence scores (Jensen, 1998).

In another study, (Watkins, Lei, & Canivez, 2007) stated there has been considerable debate regarding the causal precedence of intelligence and academic achievement. Some researchers view intelligence and achievement as identical constructs. Others believe that the relationship between intelligence and achievement is reciprocal. Still others assert that intelligence is causally related to achievement (Laidra, Pullmann, & Allik, 2007) reported that students’ achievement relies most strongly on their cognitive abilities through all grade levels.

Academic achievement is a complex performance. However, the determiners of the level of achievement in school courses are not yet definitely pinpointed. But, there is enough evidence to show that academic achievement is not one-dimensional phenomena, but a multidimensional activity. Oates (1929), Eysenck (1960), Vernon (1961) and Mohan & Kumar (1975) suggest that intelligence; personality, learning method and motivational variables are responsible for total academic performance. There have been considerable numbers of scientific investigations in the area of academic achievement in order to find out its stable determiners.

Some attempts have been fructified in establishing the direct relationship between certain variables while some are still under investigation. There are different correlates of academic achievement viz. personality, intelligence, study habits, locus of control, achievement motivation, adjustment, creativity, attitude, field dependence-independence etc. But, the best correlate of academic achievement is intelligence which is a well established fact (Sinha, 1970; Dhaliwal & Sharma, 1994; Sharma, 2008). Whatsoever, there are various other researches where the correlation between intelligence and academic achievement have been found to be low, insignificant and even low negative (Lewis & Todd, 1978; Mehta & Kumar, 1985 and Kumari & Rao, 2000).

Although during the almost period of one hundred years a general agreement has been reached that there is no sex difference in overall general intelligence (Douglas and Rushton, 2006) but several studies have been reported gender differences in intelligence (Furnham et al., 1999). They support gender differences in specific cognitive abilities; some support females and some support males (Hyde, 2005; Lynn et al., 2002) but many of such studies find no sex differences in intelligence (Halpern and Lamay, 2000).

Reney P. Varghese, T. Selvin Jeharaj Norman & H. Samuel Thavaraj (2015), in their review on Perceived Stress and Self Efficacy among College Students: A Global Review, of the studies conducted worldwide with particular emphasis about the impact of perceived stress among college students on academic performance and further excellence. The review found that, high perceived stress results in low academic performance and vice versa. The perceived is related to the intelligence of the students. Different research findings also suggest that, level of perceived stress differs depending on the courses which the students are learning and also there are gender related differences. Female students were found to have greater levels of stress and more health problems.

However, men in the sample appeared to overestimate their intelligence, while the women were quite accurate in estimating their intelligence. Habibollah et al., (2008) reported there were no significance between males and females on intelligence but the result shows males’ means are higher than females.

Devi, (1990) "Conducted a study on correlation of academic achievement and intelligence and found slight significant correlation with intelligence. In a study Garg (1992) found linear relationship between Intelligence and academic achievement of students. Dixit (1985) also found an average correlation between intelligence test scores and academic achievement of boys and girls. In these studies the linear and average correlation between Intelligence and academic achievement is due to home and the environment of the institution, economic status and study habits.

**Need Of The Study**

It is impossible to achieve without corresponding intelligence, which is comprised of mental abilities. Ability is about the quality of being able to do something, which serves as the foundation of achievement. School education is an important segment of the total educational system contributing significantly to the individual as well as to the national development. A good school provides an environment which is conducive for the development of cognitive, affective and psychomotor domains for overall development of individuals. The primary function of the school is the imparting of academic skills.

Early research on the predictors of academic achievement focused primarily on intellectual and ability factors. There is considerable evidence that intelligence alone does not account for all the variance in academic achievement (Levin 1967, Cattel Butcher, 1968, Vernon
Although intelligence is perhaps the still most affect predictor of academic achievement, In line with the aim of this investigation, the research questions as follows: What is the significant relationship between intelligence and academic achievement? Are there any differences between females and males in terms of the relationship between intelligence and academic achievement?

Objectives Of The Study.
In view of the issues raised in the background, this study is aimed at:
a) To study the level of intelligence of science students in higher secondary.
b) To find out the difference between level of intelligence of boys and girls students.
c) To find out the relationship between Intelligence and academic achievement.

Hypothesis
Only research question number 2 and 3 was hypothesized for this study:
a) There is no significant difference between the intelligence acquired by boys and girls science students in higher secondary.
b) There is no significant correlation between Intelligence and academic achievement of science students in higher secondary.

Methodology
The investigator adopted survey method for the present study. The sample of the present study comprised of XII standard students studying in Karaikal City. In the present study stratified random sampling technique was used to select the samples. A sample of 300 students were selected from five schools, out of which 150 boys and 150 girls.

Tools Used for Analysis
1. Intelligence Scale: The Intelligence Scale constructed and validated by investigator. In order to establish reliability the cronbach alpha co-efficient was estimated for intelligence scale. It was calculated to be 0.809. The intrinsic validity was established by taking the square root of the reliability coefficient which was found to be 0.899.

Scoring Details: The intelligence scale consists of 105 statements. An individual score is the sum of all the score of the 105 items. The maximum score that one can get in this is 105. Higher score indicating the presence of more intelligence. Each item carries one mark. By taking the total marks obtained by the students further calculations were done and they were classified into low, average, high in their Intelligence.

2. Academic Achievement: Percentage of Plus two public exam marks of higher secondary students were taken as Academic achievement.

Results
The data collected were carefully analyzed and the following findings were deduced:

Research Question 1: What is the level of intelligence possessed by science students in higher secondary?

A summary of the mean score of science students’ intelligence is presented in the table 1 below:

Table 1: Mean Score of Intelligence

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>S.D</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intelligence</td>
<td>105</td>
<td>63</td>
<td>99</td>
<td>78</td>
<td>8.5</td>
<td>Average</td>
</tr>
</tbody>
</table>

The level of intelligence possessed by science students was determined using the following range of mean scores:
a) 87 and above - for high level – 61 students
b) 70 to 86 - for average level – 195 students
c) (iii) Below 70 - for low level – 44 students

Table 2: Shows the mean score of Student’s Intelligence

<table>
<thead>
<tr>
<th>Variable</th>
<th>Boys N=150</th>
<th>Girls N=150</th>
<th>Total N=300</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Intelligence</td>
<td>79</td>
<td>8</td>
<td>77</td>
</tr>
</tbody>
</table>

Table: 2 show that the mean score obtained was 78 which fall into the average level category. Therefore it will be concluded that the level of Intelligence possesses by science students is ‘Average’.
Table 3: Shows the level of Intelligence of higher secondary students.

<table>
<thead>
<tr>
<th>Level of Intelligence</th>
<th>Number of Respondents</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>61</td>
<td>20.3</td>
</tr>
<tr>
<td>Average</td>
<td>195</td>
<td>65</td>
</tr>
<tr>
<td>High</td>
<td>44</td>
<td>14.7</td>
</tr>
</tbody>
</table>

It is inferred from the table that the majority (65%) of students have average level of Intelligence, 20.3 % have low level of Intelligence and 14.7% have high level of Intelligence. It can be concluded from the above table that the majority of students (65%) have average level of intelligence.

Research Question 2 was hypothesized to hypothesis 1 which was further tested at 0.05 level of significance.

Table 4: Shows the level of Intelligence of Boys and Girls.

<table>
<thead>
<tr>
<th>Level of Intelligence</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
</tr>
<tr>
<td>Low</td>
<td>21</td>
<td>14%</td>
</tr>
<tr>
<td>Average</td>
<td>104</td>
<td>69.3%</td>
</tr>
<tr>
<td>High</td>
<td>25</td>
<td>16.7%</td>
</tr>
</tbody>
</table>

It is inferred from the table that the majority (69.3%) of boys have average level of Intelligence, 14.0 % have low level of Intelligence and 16.7 % have high level of Intelligence. In case of girls, a higher proportion (60.7 %) of the students has average level of intelligence, 26.7 % have low level of intelligence and 12.7 % has high level of intelligence. It can be concluded from the above table that the majority of boys (69.3%) and girls (60.7%) have average level of intelligence.

Hypothesis 1: There is no significant difference between the Intelligence acquired by boys and girls science students in higher secondary. A summary of the results of the t-test statistics is presented in table 5 below:

Table 5: t-test analysis on the Intelligence of Students based on gender

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Boys N=150</th>
<th>Girls N=150</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>105</td>
<td>Mean</td>
<td>S.D</td>
<td>Mean</td>
</tr>
</tbody>
</table>

* Not Significant at 5 % level (Null Hypothesis is accepted)

Table 5 shows that the mean score and Standard Deviation of the intelligence of boys and girls students were 79, 8 and 77, 9 respectively. The t-test was used to find out if there is a significant difference between the two means. t-value was obtained which is significant at 95% confident level. Since the significant value of 0.55 is greater than the α-value of 0.05, it simply means that the null hypothesis will be retained which implies that the difference between the means is not significant. Therefore, it will be concluded that there is no significant difference between the Intelligence acquired by boys and girls science students in higher secondary.

Table 6: Correlation between Intelligence and academic achievement of science students in higher secondary

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>r value</th>
<th>Remarks at 0.01 level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intelligence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic Achievement</td>
<td>300</td>
<td>0.690</td>
<td>Significant</td>
</tr>
</tbody>
</table>

It is observed from the above table that a positive relationship is found between Intelligence and academic achievement. The r value (0.690) is found to be significant at 0.01 level. It is positively correlation. Therefore the null hypothesis rejected. Hence, it is inferred that there is a significant correlation between Intelligence and academic achievement of science students in higher secondary. Thus it is concluded that Intelligence and academic achievement are positively related.

Findings of the Study
The findings emerged out of the present study are presented below.

a) The mean score obtained was 78 which fall into the average level category. Therefore it will be concluded that the level of Intelligence possesses by science students is ‘Average’.

b) There is no significant difference between the Intelligence acquired by boys and girls science students in higher secondary. Majority of boys and girls have average level of intelligence. Studies conducted by Douglas and Rushton, (2006), Halpern and Lamay (2000) also support the results that there is no gender difference in general intelligence.

c) There is a significant correlation between Intelligence and academic achievement of higher secondary science students. Thus it is concluded that Intelligence and academic achievement are positively correlated. Studies conducted by Panigrahi (2005) and Chamundesweri and Vaidharani (2006) also support the results that academic achievement and intelligence are significantly correlated.
Conclusion and Suggestions

This study reveals that the level of intelligence among science students in higher Secondary is average, and there is a significant correlation between intelligence and academic achievement. Based on these findings, the following suggestions were made:

a) Strategies for developing cognitive problem solving skill should be included in the higher secondary education curriculum.

b) The institutions should be very particular about the development of sound cognitive based intelligence among students through various co-curricular and extracurricular activities.

c) Cognitive problem solving skill should be developed among the students through the healthy learning environment, constructive thinking and providing an opportunity to solve problems, field trip, debate, quiz program and Group discussions, etc.

d) Associations / clubs should be formed in various subjects and each student must be assigned some responsibility. This would enhance their cognitive ability.

e) Appropriate audio-visual aids can be deployed for better cognition of the subject. Students have to be guided to utilize the library and other community resources for effective learning at their leisure time.

References


