REASONING ABILITY AND ACADEMIC ACHIEVEMENT AMONG SECONDARY SCHOOL STUDENTS IN TRIVANDRUM

By

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ABSTRACT

Reasoning ability is the 'problem solving skills' or 'analytical ability' or 'deductive and inductive reasoning'. Academic achievement is the total score one achieved at school, college, or university from class, laboratory, library, or field work. The objectives of the study were to explore the relationship between reasoning ability and academic achievement among secondary school students in Trivandrum district. Study also evaluated the difference in the mean scores of reasoning ability and academic achievement in terms of their background variables, such as gender, age, and type of school. Population of the study includes all students studying in secondary schools of Trivandrum district. The sample of the study consisted of 225 secondary school students of Trivandrum district. The tool adopted here was the Reasoning Ability of Secondary School Students Scale developed by the investigator herself and academic achievement by the term test conducted in the school by the state government. Statistical techniques involved here were t-test and Pearson's Product Moment coefficient of correlation. The result of the study showed that, there was significant high positive correlation between reasoning ability and academic achievement among secondary school students. Also male students showed more reasoning ability and academic achievement than that of female students. With reference to age, and type of school also there existed significant differences in reasoning ability and academic achievement. Educators need to recognize that the age and the type of the school are also influencing the student's reasoning ability and academic achievement of the students. Hence, it is necessary to allow the students to keep in touch with the latest facilities free of cost. So, the instructors have to arrange various competitive programmes, scientific exhibitions, various programs like quiz, talent test, puzzles, etc. Society allows students to access science and technology museums to students at low cost and encourages clubs and NGOs to arrange various programmes, such as seminars, symposium, etc., which promote the reasoning ability.

Keywords: Reasoning Ability, Academic Achievement, Arithmetic Skill, Achievement Ratio, Abstract Reasoning, Logical Reasoning, Perception.

INTRODUCTION

Education in freedom India is increasing sharply and all are curious in providing education to their younger generation. During the era of globalization and technological revolution, education is considered as an important one for an individual's well-being and opportunities for better living. Education increases knowledge and thereby a person can become a part of the nation to improve per capita income of a country by suitably utilizing his education to productive work. "Role of school education has been crucial in enriching knowledge, developing skills, inculcating habits, and instilling right values among individuals and societies. It is believed that abilities developed in the childhood play a major role in overcoming the hurdles and challenges in the real life ahead-personal, social, or professional. It

begins with driving meaning from what we learn in our classrooms" (Sharma and Priyanka, 2016). Educators, trainers, and researchers are exploring factors from a long time to find out what contribute the quality of performance of learners. If a student fails to reason a problem, he cannot attain his target to score good marks and thereby, it increases his anxiety towards examination. Hence reasoning ability plays a vital role in educational settings.

Reasoning

Reasoning is said to be a productive thinking process in solving problems both in examinations and in life. "Reasoning is the process of logical thinking and problem solving; it is the thinking in terms of logical relationships and reaching logical conclusions" (Sorenson, 1954). "Reasoning ability is the act or process of a person who reasons and is the process of forming conclusions, judgments, or inferences from facts or premises, and the reasons, arguments, proofs, etc., resulting from this process" (Random House Kernerman Webster's College Dictionary, 2010). It is the process of thinking involving inference or of solving problems by employing. Reasoning is the process of finding out solutions to a problem by using an organized thought process. Here, a person utilizes his creative and critical thinking capacity to solve a problem irrespective of whether he is in a group or as an individual. "It is a word used to describe the mental recognition of cause and effect relationships. It may be the prediction of an event from an observed cause or the inference of a cause from an observed event" (Gray, 2004). Reasoning is a mental process which gives effective problem solving techniques to overcome difficulties that appears to interfere in attaining of solution. A student with effective reasoning can be identified through their use of wide range of strategies in tackling their problems, has good arithmetic skills, high self confidence, checks answers for reasonableness, and able to understand the problem and solve it with critical and analytical skills. Students with these skills exhibit high reasoning ability and are able to attempt any type of difficulties faced by them. Reasoning helps them to effectively deal with problems that they faced daily by thinking critically and creatively. Developing reasoning of a student enhances the student's ability to approach problems systematically and tackle the problems effectively in an organized manner.

Academic Achievement

Academic achievement has become an indicator of a child's future in the present extremely competitive world. "It is the performance of the student's accomplishment in a subject" (Venkateswarlu et al., 2016) Education gives freedom in context to social mobility and transforms their levels of life. It offers prosperity, wealth, and position in a life. Academic achievement is the overall capability to acquire knowledge and skills efficiently and effectively. Educator's top priority is student's academic performance since it changes world globally. Academically excellent students are expected to change a nation occupationally and economically. It refers to level of success in completing or acquiring and attaining the curriculum studies in the formal environment of schooling. It can be defined as a measure of knowledge gained in formal education usually indicated by test scores, grade, grade points, average, and degrees. "At first achievement is assumed to include only knowledge and skills. But it includes attitudes, interests, and values as aspects of achievement…. The objectives of instruction always include desired attitudes, interests, and values and are an appropriate part of the achievement test programme and may be thought of as an applicational in nature. So teachers should teach for them and parents should expect them to be taught" (Pressey, Robinson, and Horrocks, 1958). Student's academic achievement depends on teaching learning nature in a class too. Academic achievement is measured based on formative and summative assessments "In the 19th and early 20th centuries, college entrance was generally based on grades, essays, and interviews". Achievement tests are given to determine a child's academic level more precisely or to help diagnose learning problems" (Woolfolk, 2008). Right from the beginning, great stress is placed on achievement at secondary school level. This stage has its own organized hierarchy which is mainly based on achievement and

performance, because this period is a path to enter professional courses. There are various factors, which influence pupil's academic achievement, viz. school climate, parental involvement, intelligence, learning experiences at schools, parental occupation, their educational level, reasoning, personality, motivation, heredity, problem solving interest aptitudes, learning styles, and socio-economic status of the parents and many more factors.

Therefore, the topic of academic achievement has assumed a lot of meaning in the modern educational system. In our social setup, academic achievement is considered as a main standard to judge one's whole capabilities and competencies. Therefore, academic achievement occupies an essential place in teaching learning process. At present socio-economic and cultural context academic achievement is of paramount significance.

"Our school systems existence depends heavily upon assumptions about transfer of training. We assume that what children learn in the classroom today will facilitate their learning tomorrow next week. The skills and attitudes learned in the early years of the elementary school are fundamental to successful performance in later school years and in adult life….Most educators would agree that the usefulness of school learning is to be defined in terms of intellectual and aesthetic values as well as in terms of what is immediately practical" (Hudgins, 1966). In the present times, everyone desires to have a high academic performance. The entire system of education is centered on students' academic performance. Significant researches occur concentrating on the role of reasoning ability on pupils' performance. The results found that formal reasoning ability as a strong predictor for the achievement. It has been also studied that reasoning can be used to predict the performance of students' achievement.

Reasoning ability seemed to be the main predictor of academic achievement. It enhances academic achievement. The individual differences in reasoning ability could be explained by performance in academic achievement. "It is a tool for problem solving and at the same time it is a form of learning which involves the selection of past experience or the systematic search for new information that is relevant to the goal, the perception of relations and the purposeful adaptation of means to ends. It is a process which is characterized by understanding or insight" (Gates et al., 1957). Therefore, the author have to promote reasoning ability among students, so that they could excel in all walks of life. Schools should provide computer games, fascinating objects, simulation, and games of different kinds to increase reasoning capacity of students. By improving reasoning capacity of a student, he can face challenges and lead a balanced life. Hence, enhancement in the reasoning capacity of a student is acknowledged by the educationalists all over the world. For the same, teachers can play an important role by adopting various strategies and techniques, which help in the development of reasoning ability. "Motivating school children to want to learn the facts, skills, and principles now demanded in the conventional school is a big order" (Gray, 2004). They can help students to develop their advanced levels of reasoning through careful range of tasks and the use of probing questions so that students may learn problem solving approaches and use the power of extra formal reasoning to better formulate and justify mathematical calculations. "Reasoning is the higher form of thinking that needs a well organized brain. The process of reasoning requires two conditions-first that the person's mind should have completely formed concepts and the second that he should be endowed with the power of reaching decisions. It is because the children lack these two faculties that they are not able to reason. An individual give reasons from the past known circumstances to the present or further unknown conditions. In this manner reasoning helps to reach certain conclusions concerning the future without anything having been achieved in actual practice. Such an application needs some imagination as an essential part" (Sharma and Ram Nath, 1954). School administrators may put extra efforts to inculcate curriculum with reasoning and skills, so that students may get opportunity to sharpen their skills. "A successful reason ties together several isolated

experiences and re-organizes them for his solution. Pupils can be helped to analyze their procedures by comparing them with successful models. Training and practice in abstracting, analyzing, and generalizing from the general to the concrete and vice versa" (Thompson, Gardner, and DiVesta, 1959). "The teachers need to understand their learners with a view to prepare well for facilitating learning of different group of learners. It is known for most teachers tend to teach in the way they were taught or in the way they preferred to learn" (Sahoo and Chandra, 2015). But, if a teacher develops an understanding of learning environments and styles teachers can maximize their potential for learning. If the reasoning ability and achievement of an individual are better, they can fruitfully serve the society. India is a developing country and we require such type of individuals with high reasoning capability to achieve a better position in the world.

1. Need and Significance of the Study

Reasoning ability plays a significant role in one' s life. It controls not only cognitive activities, but also influences the total behaviour and personality. Now-a-days, for all important courses, the selection process is through entrance tests and screening tests. In such a situation, one who has good knowledge and reasoning skill can get selected through entrance examination. It is essential in this context to study about the reasoning ability of secondary school students.

Reasoning ability has a significant role in the academic achievement, since the subject is dependent mostly on the abstract and logical reasoning ability of students. "The achievement of the student depends upon his conceptual learning and understanding of the topic". It further depends on number factors like child interest motivation and level of aspiration of the students. Achievement test can be used for prognostic purposes also. It is the measure of the marks in the examination by the students. The whole system of education revolves around the academic achievement of student" (Kumar and Virander, 2015). It measures a person's present status and enables the tester to judge to what extent that person is capable of profiting from further learning experiences" (Pressey, Robinson, and Horrocks, 1958). There were many research studies emphasizing the importance of problem solving ability, but limited studies were there to explain reasoning ability of students in relation to the achievement. Achievement is initially linked with reasoning capacity of a student. "Achievement ratios can give a teacher interesting information about the average attainment standards of his classes" (Hughes, A. G. and Hughes, E. H. 1959). A student can get sure good marks in examination only if he possesses greater capacity to reason an application level of questions. Then we can say that the achievement is greater for students with good reasoning ability. From this, the investigator found that there was a scarcity of research in the field of this area and hence decided to conduct a research on reasoning ability in connection with academic achievement.

Suresh (2014) conducted a study on Reasoning Ability In Science (RAIS) among college students and found that gender, locality, type of college, type of management, communities, father's occupation are significant in reasoning ability. Gnanadevan and Selvaraj (2013) conducted a study on Reasoning ability, Science Attitude, and Academic achievement among Higher Secondary Students and found that reasoning ability had an influence on academic achievement of the students. Kusuma (2009) conducted a study on Reasoning Ability and Academic Achievement of ashram and non-ashram school children and found that reasoning ability have a strong relation with academic achievement. Murugan and Thilagavathy (2014) conducted a study on Higher secondary student's reasoning ability and home environment and found that there was significant relation with reasoning ability and the care given from the home. Also Murugarajan (2008) conducted Abstract Reasoning ability of Commerce students studying in school and found that the abstract reasoning ability of commerce students were positively influenced by the problems associated with the subject.

The investigator referred so many journals, books; magazines, etc., and found that there was a scarcity of research in the connected area of Reasoning Ability and Academic achievement. Hence, the investigator decided and intended to conduct a study on Reasoning

Ability and Academic Achievement among secondary school students.

2. Statement of the Problem

The Problem is entitled as "Reasoning Ability and Academic Achievement among Secondary School Students in Trivandrum ".

3. Definition of the Key Terms

3.1 Reasoning Ability

"Reasoning is productive thinking in which previous experiences are reorganized, or combined in new ways to solve a problem" (Gates et al., 1957).

"An ability to generalize or which presumes an ability on the part of the subject to perceive certain relationships and associations between different objects and situations" (Pasricha and Prem, 1963).

3.2 Academic Achievement

"The status or level of a person's learning and his ability to apply what he has learned" (Pressey, Robinson, and Horrocks, 1958).

"Academic achievement is the performance in school in a standardized series of educational tests. The term is more generally used to describe performance in the subjects of the curriculum" (Sekar and Lawrence, 2016).

In the present study, the investigator took the score of students in midterm marks from the examination conducted by the State Government.

3.3 Secondary School Students

"A school that is intermediate in level between elementary school and college and that usually offers general, technical, vocational, or college preparatory curricula" (Dictionary of the English language, 2016 Retrieved from https://www.thefreedictionary.com/ secondary+school).

In this study, the students who are studying in class VIII is recognized as secondary school students whose age is 12-13 years.

4. Objectives of the Study

- To find the relationship between reasoning ability and academic achievement among secondary school students.
- To find the difference in reasoning ability of secondary school students with respect to gender.
- To find the difference in academic achievement of secondary school students with respect to gender.
- To find the difference in reasoning ability of secondary school students with respect to age.
- To find the difference in academic achievement of high school students with respect to age.
- To find the difference in reasoning ability of secondary school students with respect to type of school.
- To find the difference in academic achievement of secondary school students with respect to type of school.

5. Hypotheses of the Study

- There is no relationship between reasoning ability and academic achievement among secondary school students.
- There is no significant difference in the mean scores of reasoning ability of secondary school students with respect to gender.
- There is no significant difference in the mean scores of academic achievement of secondary school students with respect to gender.
- There is no significant difference in the mean scores of reasoning ability of secondary school students with respect to age.
- There is no significant difference in the mean scores of academic achievement of secondary school students with respect to age.
- There is no significant difference in the mean scores of reasoning ability of secondary school students with respect to type of school.
- There is no significant difference in the mean scores of academic achievement of secondary school students with respect to type of school.

6. Methodology

6.1 Method

Survey method was adopted in the study. A survey method means predetermined set of questions are given

to a sample to collect information about how people think and act.

Here survey method is conducted for reasoning ability of secondary students which consists of predetermined set of questions that is given to a representative sample.

6.2 Population

Population means the entire group of people where the researcher wishes to conduct his research.

The population in this study consisted of the secondary school students of various high schools located in Trivandrum district.

6.3 Sample

A sample is one that is representative of the larger population of interest. A researcher can describe the attitudes of the population from which the sample was drawn.

The samples were 225 secondary school students from Trivandrum district. In this, 120 males and 105 females were selected randomly.

6.4 Tools

Tools are the sources for collecting information from the samples.

The tool adopted here was the Reasoning Ability of Secondary School Students Scale developed by the investigator herself and academic achievement by the term mid test conducted in the school by the State Government.

6.5 Statistical Technique

Statistical techniques involved here were Pearson's Product Moment coefficient of correlation, t-test, and ANOVA.

7. Analysis and Interpretation

7.1 Hypotheses Testing using Correlation

7.1.1 Relationship Between Reasoning Ability and Academic Achievement

7.1.1.1 Hypothesis 1

There is no relationship between reasoning ability and academic achievement among secondary school students.

Table 1 indicates the relation between Reasoning ability and Academic achievement obtained on a sample of 225 students was found to be 0.728. This indicated that at 0.05 level of significance there existed significant high correlation between the two variables. Therefore, on the basis of Table 1, the Hypothesis 1 "There is no relationship between reasoning ability and academic achievement among high school student" was rejected. There was significant high positive correlation between reasoning ability and academic achievement among secondary school students.

7.2 Hypotheses Testing using t-test

7.2.1 Comparison of Reasoning Ability of Secondary School Students with respect to Gender

7.2.1.1 Hypothesis 2

There is no significant difference in the mean scores of reasoning ability of secondary school students with respect to gender.

The difference in the male and female students in their reasoning ability was found using t test on a sample of 225 secondary school students. The result was shown in Table 2.

From Table 2, it was found that mean and standard deviation of male students is 25.36 and 3.232, respectively. The mean and standard deviation of female students are 23.45 and 3.456, respectively. Here the calculated t value was 4.292, which was greater than that of the table value 1.98 at level 0.05. The value t was found to be significant statistically. Therefore, on the basis of the results given in Table 2, Hypothesis 2, "There is no significant difference in the mean scores of reasoning

Variables	N	r	Variable Interpretation
Reasoning Ability and Academic Achievement	225	0.728	High correlation

Table 1. Data and Results of Correlation: Relationship between Reasoning Ability and Academic Achievement of Secondary School Students

Variable	Groups	N	M	SD	t-test	Level of Significance
Reasoning ability	Male	105	25.36	3.232	4.292	S
	Female	120	23.45	3.456		

Table value at 0.05 level is 1.98

Table 2. Data and Results of t-Test: Comparison of Reasoning Ability of Secondary School Students with respect to Gender

ability of secondary school students with respect to gender" was rejected. This means that male and female students showed differences in their reasoning ability. From the mean scores, it was found that male students showed more reasoning ability than that of the female students.

7.2.2 Comparison of Academic Achievement of Secondary School Students with respect to Gender

7.2.2.1 Hypothesis 3

There is no significant difference in the mean scores of academic achievement of secondary school students with respect to gender.

The difference in the male and female students in their academic achievement was found using t test on a sample of 225 secondary school students. The result was shown in Table 3.

Table 3 showed that mean and standard deviation of male students was 335.26 and 16.86, respectively. The mean and standard deviation of female students is 330.35 and 15.56, respectively. Here, the calculated t value was 2.258, which was greater than that of the table value 1.98 at level 0.05. The value t was found to be significant statistically. Therefore, on the basis of the results given in Table 3, Hypothesis 3, "There is no significant difference in the mean scores of academic achievement of secondary school students with respect to gender" was rejected. From the mean value, it was showed that male students showed more academic achievement than that of the female students.

7.3 Hypotheses Testing using "ANOVA"

7.3.1 Comparison of Reasoning Ability of Secondary School Students with respect to Age

7.3.1.1 Hypothesis 4

There is no significant difference in the mean scores of reasoning ability of secondary school students with respect to age.

The significant difference among secondary school students whose ages 13, 14, and 15 in their reasoning ability were found using ANOVA on a sample of 225 secondary school students. The result is shown in Table 4.

The F value presented in Table 4 revealed that there existed no significant difference among three groups of 13, 14, and 15 age group in secondary school students for their reasoning ability. Since the calculated F value (3.760) was greater than the table value (3.05) for 2,222 degrees of freedom at 0.05 level significance. On the basis of the results given in Table 4, Hypothesis 4, "There is no significant difference in the mean scores of reasoning ability of secondary school students with respect to age" was rejected. This means that there existed significant difference in reasoning ability of secondary school students with respect to age.

7.3.2 Comparison of Academic Achievement of Secondary School Students with respect to Age

7.3.2.1 Hypothesis 5

There is no significant difference in the mean scores of academic achievement of secondary school students with respect to age.

The significant difference among 13, 14, and 15 age group in their academic achievement were found using ANOVA on a sample of 225 secondary school students. The result was shown in Table 5.

The F value presented in Table 5 revealed that there existed significant difference among three groups 13, 14, and 15 age group of secondary school students for their academic achievement. Since the calculated F value (3.246) was greater than that of the table value 3.05 for 2, 222 degrees of freedom at 0.05 level significance on the

Groups	N	M	SD	t-test	Level of Significance
Male	105	335.26	16.86	2.258	S
Female	120	330.35	15.56		

Table value at 0.05 level is 1.98

Table 3. Data and Results of t -Test: Comparison of Academic Achievement of Secondary School Students with respect to Gender

Source	SS	df	MS	F	Level of Significance
Between Groups	486.35	2	243.175	3.760	S
Within Groups	14356.61	222	64.669		

Table value at 0.05 level is 3.05

Table 4. Data and Results of ANOVA: Comparison of Reasoning Ability of Secondary School Students with respect to Age

Source	SS	df	MS	F	Level of Significance
Between Groups	4625.23	2	2312.615	3.246	S
Within Groups	158126.3	222	712.28		

Table value at 0.05 level is 3.05

Table 5. Data and Results of ANOVA: Comparison of Academic Achievement of Secondary School Students with respect to Age

basis of the results given in Table 5, Hypothesis 5, "There is no significant differences in the mean scores of achievement of secondary school students with respect to age" was rejected. This means that there existed significant difference in academic achievement of secondary school students with respect to age.

7.3.3 Comparison of Reasoning Ability of Secondary School Students with respect to Type of School

7.3.3.1 Hypothesis 6

There is no significant difference in the mean scores of reasoning ability of secondary school students with respect to type of school.

The significant difference among government, aided, and private in their reasoning ability were found using ANOVA on a sample of 225 secondary school students. The result was shown in Table 6.

The F value presented in Table 6 revealed that there existed significant difference among three groups, namely government, aided, and private of their reasoning ability. Since the calculated F value (4.930) was greater than that of the table value 3.05 for 2,222 degrees of freedom at 0.05 level significance. On the basis of the results given in Table 6, Hypothesis 6 "There is no significant differences in the mean scores of reasoning ability of secondary school students with respect to type of school" was rejected. This means that there existed significant difference in reasoning ability of secondary school students with respect to type of school.

Source	SS	df	MS	F	Level of Significance
Between Groups	562.33	2	281.165	4.930	S
Within Groups	12658.65	222	57.021		

Table value at 0.05 level is 3.05

Table 6. Data and Results of ANOVA: Comparison of Reasoning Ability of Secondary School Students with respect to Type of School

7.3.4 Comparison of Academic Achievement of Secondary School Students with respect to Type of School

7.3.4.1 Hypothesis 7

There is no significant difference in the mean scores of academic achievement of secondary school students with respect to type of school.

The significant difference among government, aided, and private in their academic achievement were found using ANOVA on a sample of 225 secondary school students. The result was shown in Table 7.

The F value presented in Table 7 revealed that there existed significant difference among three groups, namely government, aided, and private Schools of students for their achievement. Since the calculated F value (3.311) was greater than that of the table value 3.05 for 2,222 degrees of freedom at 0.05 level significance on the basis of the results given in Table 7, Hypothesis 7, "There is no significant difference in the mean scores of academic achievement of secondary school students with respect to type of school" was rejected. This means that there existed significant difference in academic achievement in secondary school students with respect to type of school.

8. Findings and Discussions of the Study

8.1 Finding based on Correlation

From Table 1, it was found that the calculated r (0.728) value showed that there was significant high positive correlation between reasoning ability and academic achievement among secondary school students.

8.2 Findings based on t-test

From Table 2, it was found that mean and standard deviation of male students are 25.36 and 3.232, respectively. The mean and standard deviation of female

Source	SS	df	MS	F	Level of Significance
Between Groups	4663.65	2	2331.82	3.311	S
Within Groups	156348.2	222	704.27		

Table value at 0.05 level is 3.05

Table 7. Data and Results of ANOVA: Comparison of Academic Achievement of Secondary School Students with respect to Type of School

students are 23.45 and 3.456, respectively. Here the calculated t value was 4.292, which was greater than that of the table value 1.98 at level 0.05. The value t was found to be significant statistically. Therefore, on the basis of the results given in Table 2, Hypothesis 2, "There is no significant difference in the mean scores of reasoning ability of secondary school students with respect to gender" was rejected. This means that male and female students showed differences in their reasoning ability. From the mean scores, it was found that male students showed more reasoning ability than that of the female students.

Table 3 showed that mean and standard deviation of male students was 335.26 and 16.86, respectively. The mean and standard deviation of female students is 330.35 and 15.56, respectively. Here the calculated t value was 2.258, which was greater than that of the table value 1.98 at level 0.05. The value t was found to be significant statistically. Therefore, on the basis of the results given in Table 3, Hypothesis 3, "There is no significant difference in the mean scores of academic achievement of secondary school students with respect to gender" was rejected. From the mean value, it was showed that male students showed more academic achievement than that of the female students.

8.3 Findings based on ANOVA

The F value presented in Table 4 revealed that there existed significant difference among three groups of 13, 14, and 15 age groups in secondary school students for their reasoning ability. Since the calculated F value (3.760) was greater than the table value (3.05) for 2,222 degrees of freedom at 0.05 level significance. On the basis of the results given in Table 4, Hypothesis 4, "There is no significant difference in the mean scores of reasoning ability of secondary school students with respect to age" was rejected. This means that there existed significant difference in reasoning ability of secondary school students with respect to age.

The F value presented in Table 5 revealed that there existed significant difference among three groups 13, 14, and 15 age groups of secondary school students for their academic achievement. Since the calculated F value (3.246) was greater than that of the table value 3.05 for 2, 222 degrees of freedom at 0.05 level significance on the basis of the results given in Table 5, Hypothesis 5, "There is no significant differences in the mean scores of achievement of secondary school students with respect to age" was rejected. This means that there existed significant difference in academic achievement of secondary school students with respect to age.

The F value presented in Table 6 revealed that there existed significant difference among three groups namely government, aided, and private secondary school students of their reasoning ability. Since the calculated F value (4.930) was greater than that of the table value 3.05 for 2, 222 degrees of freedom at 0.05 level significance. On the basis of the results given in the Table 6, Hypothesis-6, "There is no significant differences in the mean scores of reasoning ability of secondary school students with respect to type of school" was rejected. This means that there existed significant difference in reasoning ability of secondary school students with respect to type of school.

The F value presented in Table 7 revealed that there existed no significant difference among three groups namely government, aided, and private of secondary school students for their achievement. Since the calculated F value (3.311) was greater than that of the table value 3.05 for 2, 222 degrees of freedom at 0.05 level significance on the basis of the results given in Table 7, Hypothesis 7, "There is no significant difference in the mean scores of academic achievement of secondary school students with respect to type of school" was rejected. This means that there existed significant difference in academic achievement in secondary school students with respect to type of school.

Conclusions of the Study

From the study, it was found that there was significant high positive correlation between reasoning ability and academic achievement among secondary school students. Hence, in order to get training to score high marks in academic achievement, a student must get

training to raise their capacity for reasoning. Also it is found from the study that male students showed more reasoning ability and academic achievement than that of the female students. This may be due to the exposure of male students to more problematic situations than that of girls. Educators must keep in mind that they have to give extra exercises in order to overcome the gender differences in reasoning ability and academic achievement. With reference to age and type of school also there existed significant differences in reasoning ability and academic achievement. Educators need to recognize that the age and the type of the school are also influencing the students reasoning ability and academic achievement of the students and suitable measures have to be adopted in order to raise the productivity of students.

Implications of the Study

To the Teachers

- Instructors must arouse the interest of the students by giving the daily life related examples and experiences in them so as to raise the reasoning ability and academic achievement of students.
- Positive reinforcement should be given to students if they show any improvised aids or innovative experiments in class.
- Opportunities should be given to them to speak out freely about the innovative and varied ideas about different things.
- Students should be given opportunities to do hands on experiences and provide them first hand experiences as much as possible.

To the School Authorities

- Allow the students to keep in touch with the latest facilities and should allow it free of cost.
- Various competitive programmes and scientific exhibitions should be allowed to students.
- Conduct various programs like quiz, talent test, puzzles, etc.
- Incentives should be provided to the talents.
- Appoint well talented teachers.

To the Society

- Science and technology museums of government should be open for students at low cost.
- Encourage mass media to publish education related news and others.
- Encourage clubs and NGOs to arrange various programmes, such as quiz programs, symposium, etc., to promote the reasoning ability.

Delimitation of the Study

The present study has following delimitations.

- The study is restricted to secondary school students.
- The study is restricted to Kerala state only.
- The sample has been limited to 225 students.

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