ISSN: 0976-3031

Available Online at http://www.recentscientific.com

CODEN: IJRSFP (USA)

International Journal of Recent Scientific Research
Vol. 9, Issue, 1(I), pp. 23524-23528, January, 2018

International Journal of Recent Scientific Research

DOI: 10.24327/IJRSR

Research Article

REASONING ABILITY AND ACADEMIC ACHIEVEMENT OF HIGHER SECONDARY STUDENTS

Kanmani M[1] and Nagarathinam N[2]

Department of Educational Technology, TNTEU, Chennai. Tamilnadu

DOI: http://dx.doi.org/10.24327/ijrsr.2018.0901.1484

ARTICLE INFO

Article History:

Received 15th October, 2017
Received in revised form 25th October, 2017
Accepted 23rd December, 2017
Published online 28th January, 2018

ABSTRACT

Every student has potential for higher-order thinking. The key is to unlock the world of mathematics through a student's natural inclination to strive for purpose and meaning. Reasoning is fundamental to the knowing and doing of mathematics. The present study aims to find out the relationship between reasoning ability and achievement in mathematics of higher secondary students. Fifty five, higher secondary students were randomly selected as sample. Survey method was adopted for the study. The data was collected using a test on reasoning ability (RA). Critical ratio(t-test), chi-square test and Pearson's product moment correlation were applied to test the hypotheses. Interpretations were drawn based on the findings. Reasoning ability of the higher secondary students was found to be an *average* and there was a *high positive correlation* between reasoning ability and achievement in mathematics.

INTRODUCTION

Mathematical reasoning is the critical skill that enables a student to make use of all other mathematical skills. With the development of mathematical reasoning, students recognize that mathematics makes sense and can be understood. They learn how to evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe solutions, and recognize how those solutions can be applied. Mathematical responders are able to reflect on solutions to problems and determine whether or not they make sense. They appreciate the pervasive use and power of reasoning as a part of mathematics.

To give more students access to mathematics as a powerful way of making sense of the world, it is essential that an emphasis on reasoning pervade all mathematical activity. In order to become confident, self-reliant mathematical thinkers, students need to develop the capability to confront a mathematical problem, persevere in its solution, and evaluate and justify their results.

Inductive reasoning involves looking for patterns and making generalizations. Students may use inductive reasoning to discover patterns in multiplying by ten or a hundred or in working with exponents. Learning mathematics should involve a constant search for patterns, with students making educated guesses, testing them, and then making generalizations. The generalizations are obtained by using inductive reasoning can only be accepted by "proving" them through deductive reasoning.

Deductive reasoning involves making a logical argument, drawing conclusions, and applying generalizations to specific situations. This kind of reasoning may involve eliminating unreasonable possibilities and justifying answers. Although students as young as first graders can recognize valid conclusions, the ability to use deductive reasoning improves as students grow older. More complex reasoning skills, such as recognizing invalid arguments, are appropriate at the secondary level.

Reason is the capacity for consciously making sense of things, establishing and verifying facts, applying logic, and changing or justifying practices, institutions and beliefs based on new or existing information. Reasoning skills are essential to day-to-day life: we use them to make choices among possible options, to distinguish between positive and negative situations, to decide how to approach a problem and resolve it, and much more. As we consider some more specific examples, keep in mind this equation, which may help you to understand how it all works.

Corresponding author:* **Kanmani M
Department of Educational Technology, TNTEU, Chennai. Tamilnadu

Mathematical reasoning is essential to bridging the gap between basic skills and higher-order thinking. In fact, research has shown that students who are taught reasoning skills early on ultimately become more confident, independent learners; they have a deeper understanding of how a concept can be applied in a variety of situations and are willing to take risks to see what works and what doesn't.

REVIEW OF RELATED LITERATURE

Ehtesham Anwar (2015) conducted a study on reasoning ability of secondary school students in relation to their intelligence. It is revealed from the study that there is no significant difference in the intelligence score of Government and Private secondary school students. It had also shown that Private school students had higher reasoning ability as compared to the Government school students.

Ashima Bhandari and Rashpalkaur (2016) conducted a study on impact of reasoning ability of mathematical achievement of senior secondary students. It is revealed from the study that there was no significant difference regarding reasoning ability between male and female senior secondary students. There was significant difference regarding the mathematical achievement between male and female senior secondary student. There was significant relationship regarding reasoning ability and mathematical achievement among female senior secondary students.

Ayal et al (2016) conducted a study on the enhancement of mathematical reasoning ability of junior high school students by applying mind mapping strategy. It is revealed from the study that there is a difference achievement, the enhancement of KPM (high, medium and low) in experiment class and control class. There is an interaction between learning and school rank (low, high and medium) in enhancing the ability of mathematical reasoning. There is no interaction between learning and KAM (high, medium and low) in increasing reasoning ability.

Reasoning ability among higher secondary students studied by Kanimozhi.P and Ganesan.P (2017). It is revealed from the study that there exists a positive correlation between mathematical achievement and reasoning ability. There is no significant difference in reasoning ability among higher secondary students in terms of gender.

Need and significance of the study

Understanding the power of reasoning to make sense of mathematics is critical to helping students become self-reliant, independent mathematical thinkers. Students must be able to judge for themselves the accuracy of their answers. They must be able to apply mathematical reasoning skills in other subject areas and in their daily lives. They must recognize that mathematical reasoning can be used in many different situations to help them make choices and reach decisions. Mathematical reasoning is the glue that binds together all other mathematical skills. By using inductive and deductive reasoning as they learn mathematical concepts and solve mathematical problems, students come to recognize the extent to which reasoning applies to mathematics and to their world.

Objectives of the study

1. To find out the level of reasoning ability and achievement in mathematics of higher secondary students.
2. To find out whether there is any significant relationship between reasoning ability and academic achievement in mathematics of higher secondary students.
3. To find out whether there is any significant association in achievement in mathematics of higher secondary students with respect to educational qualification of fathers and mothers.
4. To find out whether there is any significant association in reasoning ability of higher secondary students with respect to educational qualification of fathers and mothers.
5. To find out whether there is any significant difference in achievement in mathematics of higher secondary students with respect to
   a. Gender
   b. Group of study
   c. Type of school
6. To find out whether there is any significant difference in reasoning ability of higher secondary students with respect to
   a. Gender
   b. Group of study
   c. Type of school

METHODOLOGY

Survey method was adapted for the study

Sample Selection

Fifty five higher secondary students were selected using random sampling technique from various schools of Kanchipuram district for the study.

Research Instruments Used

A test on Reasoning Ability (RA) and Achievement Test were constructed and validated by Dr.M.Kanmani and Nagarathinam (2016).

Reasoning Ability Test

Description of the tool

The draft tool contained fifty items to assess the reasoning ability of higher secondary students.

Validity

Content validity was found using item-wise analysis. The items which have difficulty value between 40 and 60, and discrimination index ≥ 0.4 were selected. Hence, twenty eight items were selected.

Reliability

Split-half technique was used to establish the coefficient of reliability of RA test and it was found to be 0.76. Hence the tool is *highly reliable*.

Scoring procedure

One mark was awarded for correct answer and no mark was awarded for wrong answer.

Statistical techniques used

Critical ratio (t-test), Chi-Square test and Pearson's product moment correlation techniques were used for analyzing the data.

Achievement Test

Description of the tool

The draft tool contained fifty items to assess the achievement test of higher secondary students.

Validity

Content validity was found using item-wise analysis. The items which have difficulty value between 40 and 60, and discrimination index ≥ 0.4 were selected. Hence, twenty eight items were selected.

Reliability

Split-half technique was used to establish the coefficient of reliability of achievement test and it was found to be 0.5. Hence the tool is *reliable*.

Scoring procedure

One mark was awarded for correct answer and no mark was awarded for wrong answer.

Statistical techniques used

Critical ratio (t-test), Chi-Square test and Pearson's product moment correlation techniques were used for analyzing the data.

Hypothesis testing

Hypothesis 1*: There is no significant relationship between reasoning ability and achievement in mathematics of higher secondary students*.

Variables	'r'	Table value
Reasoning ability and Achievement in mathematics	0.87	0.254

(at 5% level of significance the table value is 0.254)

It is inferred from the above table that the calculated value of 'r' (0.87) is greater than the table value of 'r' (0.254) at 5% level of significance. Hence the null hypothesis is ***rejected***. Therefore, there is a significant relationship between reasoning ability and achievement in mathematics of higher secondary students. Further, it can be stated that there exist high positive correlation between reasoning ability and achievement in mathematics of higher secondary students.

Hypothesis 2: *There is no significant association between achievement in mathematics of higher secondary students with respect to their fathers' and mothers' educational qualification*.

Achievement Categories	Mothers' qualification			Fathers' qualification		
	Low	Average	High	Low	Average	High
Illiterate	1(1.27)	3(2.63)	1(1.09)	1(0.25)	0(0.52)	0(0.21)
10^{th}	4(4.32)	10(8.96)	3(3.7)	7(4.58)	9(9.49)	2(3.92)
12^{th}	4(4.32)	8(8.96)	5(3.7)	5(4.83)	12(10.01)	2(4.14)
UG	3(2.8)	5(5.8)	3(2.4)	1(3.3)	8(6.85)	4(2.83)
PG	2(1.27)	3(2.63)	0(1.09)	0(1.01)	0(2.1)	4(0.87)
Chi-square('χ^2')		*0.945*			*0.029*	

(at 5% level the table of significance value 'χ^2' is 15.51)

It is inferred from the above table that the calculated values of 'χ^2' (0.945 and 0.029) are less than the table value 15.51 at 5% level of significance. Hence the null hypothesis is ***accepted***. Therefore, fathers' and mothers' educational qualification of higher secondary students did not associate significantly in achievement in mathematics.

Hypothesis 3: *There is no significant association between reasoning ability of higher secondary students with respect to their fathers' and mothers' educational qualifications*.

Reasoning Ability Categories	Mothers' qualification			Fathers' qualification		
	Low	Average	High	Low	Average	High
Illiterate	0(0.81)	5(3.27)	0(0.9)	1(0.16)	0(0.65)	0(0.18)
10^{th}	7(2.78)	8(11.12)	2(3.09)	3(2.94)	13(11.78)	2(3.27)
12^{th}	1(2.78)	11(11.12)	5(3.09)	5(3.1)	3(12.43)	1(3.45)
UG	1(1.8)	8(7.2)	2(2)	0(2.1)	10(8.5)	3(2.36)
PG	0(0.81)	4(3.27)	1(0.9)	0(0.65)	0(2.61)	4(0.72)
Chi-square('χ^2')		*0.087*			*0.0003*	

(at 5% level of significance the table value 'χ^2' is 15.51)

It is inferred from the above table that the calculated values of 'χ^2' (0.087 and 0.0003) are less than the table value 15.51 at 5% level of significance. Hence the null hypothesis is ***accepted***. Therefore, fathers' and mothers' educational qualification of higher secondary students did not associate significantly in reasoning ability in mathematics.

Hypothesis 4: *There is no significant difference between boys and girls higher secondary students' achievement in mathematics*.

Gender	N	Mean	S.D	t
Boys	30	16.3	4.61	0.397
Girls	25	17.52	4.28	

(at 5% level of significance the table value 't' is 1.67)

It is inferred from the above table that the calculated value of 't' (0.397) is less than the table value of 't' (1.67) at 5% level of significance. Hence the null hypothesis is ***accepted***. Therefore, boys and girls higher secondary students' do not differ significantly in achievement in mathematics.

Hypothesis 5: *There is no significant difference in achievement in mathematics of higher secondary students with respect to group chosen.*

Group	N	Mean	S.D	t
Bio- Mathematics	29	16.1	3.69	0.35
Computer science-Mathematics	26	17.96	5.03	

(at 5% level of significance the table value 't' is 1.67)

It is inferred from the above table that the calculated value of 't' (0.35) is less than the table value of 't' (1.67) at 5% level of significance. Hence the null hypothesis is ***accepted***. Therefore, higher secondary students whose major group was biology-mathematics and computer science – mathematics did not differ significantly in achievement in mathematics.

Hypothesis 6: *There is no significant difference in achievement in mathematics of higher secondary students with respect to type of school*.

Type of School	N	Mean	S.D	t
Government Aided School	19	17.52	4.42	0.46
Self Financing School	36	16.69	4.5	

(at 5% level of significance the table value 't' is 1.67)

It is inferred from the above table that the calculated value of 't' (0.46) is less than the table value of 't' (1.67) at 5% level of

significance. Hence the null hypothesis is ***accepted***. Therefore, higher secondary students studying in government aided and self financing schools did not differ significantly in achievement in mathematics.

Hypothesis 7: *There is no significant difference between boys and girls higher secondary students' reasoning ability in mathematics*.

Gender	N	Mean	S.D	t
Boys	30	29.36	6.91	0.49
Girls	25	29.4	6.21	

(at 5% level of significance the table value 't' is 1.67)

It is inferred from the above table that the calculated value of 't' (0.49) is less than the table value of 't'(1.67) at 5% level of significance. Hence the null hypothesis is ***accepted***. Therefore, boys and girls higher secondary students do not differ significantly in their reasoning ability in mathematics.

Hypothesis 8: *There is no significant difference in reasoning ability in mathematics of higher secondary students with respect to group chosen.*

Group	N	Mean	S.D	t
Biology- Mathematics	29	29.37	7.03	0.5
Computer science-Mathematics	26	29.38	6.08	

(at 5% level of significance the table value 't' is 1.67)

It is inferred from the above table that the calculated value of 't' (0.5) is less than the table value of 't' (1.67) at 5% level of significance. Hence the null hypothesis is ***accepted***. Therefore, higher secondary students whose major group was biology-mathematics and computer science – mathematics did not differ significantly in their reasoning ability in mathematics.

Hypothesis 9: *There is no significant difference in reasoning ability in mathematics of higher secondary students with respect to type of school*.

Type of School	N	Mean	S.D	t
Government Aided School	19	30.1	6.2	0.27
Self Financing School	36	29	6.76	

(at 5% level of significance the table value 't' is 1.67)

It is inferred from the above table that the calculated value of 't' (0.27) is less than the table value of 't'(1.67) at 5% level of significance. Hence the null hypothesis is ***accepted***. Therefore, higher secondary students studying in government aided and self financing schools did not differ significantly in their reasoning ability in mathematics.

Findings

1. 65 percentage of higher secondary students had an *average level* of reasoning ability and achievement in mathematics.
2. There is *high positive correlation* between reasoning ability and achievement in mathematics of higher secondary students.
3. Fathers' and mothers' educational qualification of higher secondary students *did not associate significantly* in reasoning ability and achievement in mathematics.
4. Boys and girls higher secondary students *do not differ significantly* in reasoning ability and achievement in mathematics.
5. Higher secondary students whose major group was biology-mathematics and computer science – mathematics *did not differ significantly* in reasoning ability and achievement in mathematics.
6. iv. Higher secondary students studying in government aided and self financing schools *did not differ significantly* in reasoning ability and achievement in mathematics.

RESULT DISCUSSION

The study revealed that 65 percentage of higher secondary students had an ***average level*** of reasoning ability and achievement in mathematics. This result coincides with the study result of Emrullah and Yasin (2017). (ii). There was *high positive correlation* exists between reasoning ability and achievement in mathematics of higher secondary students, which coincides with the study result of Ashima Bhandari and Rashpalkaur (2016) and Primi et al.(2016). (iii). Boys and girls higher secondary students do not differ significantly in reasoning ability and achievement in mathematics, which coincides with the study result of Tom Lowrie et al.(2016) and contradicts with Emrullah and Yasin (2017).

Educational implications

There is high positive correlation was exist between reasoning ability and achievement in mathematics of higher secondary students. Reasoning is a process to reach a conclusion by taking all related factors into account. Individuals who have reasoning ability on a subject are knowledgeable on the related discipline and can analyze new situation which are faced in all aspects, explore, make logical assumptions, explain his thoughts, reach conclusions and defense his conclusions. Interpreting data provided in graphs and charts involves understanding the data presented and then being able to manipulate or apply that information. Careful and accurate comprehension of the data, regardless of the format it may be presented in, is the key. Deciphering patterns and determining relevant information is another aspect of numerical reasoning involving analysis and making predictions of any sort. To help students practice reasoning, have them work in pairs or groups. When they work together on a math problem, they'll be able to justify to each other how they got an answer, and they'll also be able to analyze and critique the other students' reasoning. Special lectures on complex concepts may be arranged to facilitate their learning. Guidance programme can be provided in schools according to their knowledge level.

CONCLUSION

The purpose of the present study was to find the level of reasoning ability in mathematics of higher secondary students. The study result may be useful in the field of education, which may serve as data base for further research.

Bibliography

Ayal, Carolina S.; Kusuma, Yaya S.; Sabandar, Jozua; Dahlan, Jarnawi Afgan(2016), "The Enhancement of Mathematical Reasoning Ability of Junior High School Students by Applying Mind Mapping Strategy", https://eric.ed.gov, retrieved on 07.08.17.

Ashima Bhandari and Rashpalkaur, (2016), "Impact of Reasoning Ability of Mathematical Achievement of

Senior Secondary Students", https://www.contemporaryresearchindia.net, retrieved on 19.10.17.

DIMACS (1996), "The First Four Standards", http://dimacs.rutgers.edu, retrieved on 03.12.17.

Ehtesham Anwar (2015), "A Study of Reasoning Ability of Secondary School Students in Relation to their Intelligence", http://iosrjournals.org, retrieved on 11.05.17.

Kanimozhi.P and Ganesan.P (2017), "Reasoning Ability among Higher Secondary Students". http://granthaalayah.com, retrieved on 17.09.17.

Primi, Caterina; Donati, Maria Anna; Chiesi, Francesca, (2016), "A Mediation Model to Explain the Role of Mathematics Skills and Probabilistic Reasoning on Statistics Achievement", https://eric.ed.gov, retrieved on 17.03.17.

Tom Lowrie, Tracy Logan, Ajay Ramful (2016), "Spatial Reasoning Influences Students' Performance on Mathematics Tasks", https://eric.ed.gov, retrieved on 14.03.17.

How to cite this article:

Kanmani M and Nagarathinam N.2018, Reasoning Ability And Academic Achievement of Higher Secondary Students. *Int J Recent Sci Res.* 9(1), pp. 23524-23528. DOI: http://dx.doi.org/10.24327/ijrsr.2018.0901.1484

****