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A STUDY ON RELATIONSHIP BETWEEN LOGICAL MATHEMATICAL INTELLIGENCE AND ACADEMIC ACHIEVEMENT IN MATHEMATICS OF HIGH SCHOOL STUDENTS

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"Anything that is worth teaching can be presented in many different ways. These multiple ways can make use of our multiple intelligence" - **Howard Gardner**

Intelligence is the ability to solve problems or to create products that are valued within one or more cultural settings. Everyone likes intelligent, smart, efficient and well adjustable human beings. Everyone has intelligence or combination of intelligence in a particular level.

Gardner set about studying intelligence in a systematic multidisciplinary and scientific manner, drawing from psychology, biology, neurology, sociology, anthropology, arts and humanities. This resulted in the emergence of his theory of multiple intelligence.

According to Gardner, there are biological and cultural bases for multiple intelligences. Accepting Gardner's theory of multiple intelligence has several implications for teachers in terms of classroom instruction. The theory sates that all eight intelligence are needed to productively function in the society. Since all children do not learn in the same way. Therefore an educator creates an intelligence profiles for each students to properly assess the child's progress.

Mathematics is a subject that consist of two aspects, namely knowledge and skills. In knowledge, there is much in mathematics that one simply has to know and therefore has to learn, for example, many terms, definitions, symbols and

theorems. In skills, there are many things in Mathematics that the learner must learn to do like, for example, the skills of counting, of adding and subtracting, of multiplication and division. Learning mathematics is a means of developing logical and quantitative thinking abilities.

Statement of the problem

A study on relationship between logical mathematical intelligence and academic achievement in mathematics of high school students

Definition of important terms

Logical mathematical intelligence

Logical mathematical intelligence refers to logic and mathematical ability. The ability to use numbers, understand patterns and exhibit reason are the key characteristics of logical mathematical intelligence. It is the ability to calculate, quantify, consider proportions and hypothesis and carry out complete mathematical operations. Think conceptually, abstractly and are able to see and explore patterns and relationships.

Academic achievement

Academic achievement is the outcome of education the extent to which a student, teacher or institution has achieved their educational goals. Academic achievement is commonly measured by examinations or continuous assessment.

High school students

Students studying in secondary education between the age of 13 and 16

Significance of the problem

No two individuals are alike; this is the individual differences which may differ with intelligence, behavior etc. Mathematics is a subject that consists of two aspects, namely knowledge and skills. Thinking skills certainly are needed to help children try to make sense of the world. Mathematics serves as the basis of modern innovations, discoveries and research studies. Students nowadays tend not to apply the concept of mathematics in the solution of meaningful problems since they were bombarded with the different factors affecting their academic achievement in mathematics in solving complex problems. Among thinking skills, logical thinking

skill is one of the important in mathematics of modern education. Logical thinking skill deals with the ability of solving mathematical problems. Unfortunately it's role in learning is grossly underestimated.

For this reason, it is necessarily important to examine students logical and mathematical intelligence in one of the school in Alappuzha district (Mother Theresa High School, Muhamma).

Objectives of the study

1. To find out the level of logical mathematical intelligence of standard IX students
2. To find out the level of academic achievement in mathematics of standard IX students
3. To find out the relationship between logical mathematical intelligence and academic achievement in mathematics of standard IX students

Hypotheses of the study

1. The level of logical mathematical intelligence of standard IX students are high
2. The level of academic achievement in mathematics of standard IX students are high
3. The correlation between logical mathematical intelligence and academic achievement in mathematics is high

Delimitation of the study

1. Only one school is taken for the study
2. Only Malayalam medium class is taken for the study
3. The study is limited to IXth standard students

Review of related literature and studies

Anastasow (1984) reviewed Gardner's famous book: "Frames of mind: A theory of multiple intelligence", in which Gardner discusses the impact of experiences on the brain genetic program, the plasticity of the young brain, and the law and continuous growth of the brain with the higher mental functions maturing later.

Munro (1994) examined multiple intelligence model of individual ways of learning and its implications for mathematics teaching. The alternative ways that

students used were mathematical ideas, management or control mechanisms and related models of learning preferences, ways in which students relate and manipulate ideas for the teaching of mathematics.

Coleman, et al (1997) in their Action Research Project evaluated a program for decreasing the gap in achievement level among primary and secondary students in the targeted school based on teaching with the multiple intelligence. Along with it, incorporation of teaching strategies such as co-operative learning, projects and meta cognitive processing will determine if discrepancies in achievement levels will be minimized.

Wiseman (1997) stated that historically educators in the United States have used the Stanford- Binet intelligence test measure students ability in logical mathematical intelligence and linguistic verbal domain. This measurement is being used by a society that has evolved from agrarian and industrial based economics to what presently labeled a technological society.

Roesch (1997) studied the perspectives of English teachers on multiple intelligence theory in the high school classroom results that half of the English teachers were linguistic learners and that half of the English teachers were non-linguistic learners.

Borrego(1999) conducted a study to examine the application of multiple intelligence principles by spatial education teachers in terms in classroom environmental adaptations. It indicated that training provided in multiple strategy enhanced the ability of spatial education in terms to implement environmental modifications effectively in the classroom.

Methodology

Survey method was used in the study

Sample

Data were collected from 42 students (IXth standard) from Mother Teresa High School, Muhamma, Alappuzha. Out of these 20 students were boys and 22 were girls.

Design and procedure used

Before collecting the data, the Investigators contact the school authorities and take permission for collection of data without disturbing the emotions of students. They were assured that data would be used for research purpose only and the response would be kept confidential First the Investigator prepared 35 questions and after consult with expert it was reduced to 20 questions.

Collection of data

For collecting the data, the Investigator used a five point scale for measuring the logical mathematical intelligence and conducting an achievement test on mathematics for measuring the academic level of the students.

Measures adopted for the calculation

Mean, standard deviation, correlation etc used

Achievement test

It was prepared based on the blue print

Table 1

Weightage to objectives

Sl.no	Objectives	No. of questions	scores	percentage
1	Remembering	2	2	8%
2	Understanding	4	6	24%
3	Applying	6	9	36%
4	Analysising	1	2	8%
5	Evaluating	1	4	16%
6	Creating	1	2	8%
	Total	15	25	100%

Table 2

Weightage to content

Sl no	Content	No. of questions	Scores	Percentage
1	Two types of numbers	5	10	40%
11	The Points and numbers	4	6	24%
111	Linear algebra	4	6	24%
1V	Multiple processes	2	3	12%
	Total	15	25	100%

Table 3

Weightage to form of questions

Sl no.	Form of question	No. of questions	scores	percentage
1	easy	7	7	28%
2	average	7	14	56%
3	difficulty	1	4	16%
	Total	15	25	100%

Table 4

Weightage to difficulty level

Sl no	Difficulty level	No. of questions	Scores	Percentage
1	easy	7	7	28%
2	average	7	14	56%
3	difficult	1	4	16%
		15	25	100%

Table 5

Blue print

Instructional objectives	Remembering			Understanding			Applying			Analysing			Evaluating			creating			Total
Content/form of question	O	SA	E	O	SA	E	O	SA	E	O	SA	E	O	SA	E	O	SA	E	
Content 1	$(1)^1$			$(1)^1$	$(2)^2$										$(1)^4$				10
Content 11	$(1)^1$			$(1)^1$				$(2)^2$											6
Content111							$(2)^1$				$(1)^2$						$(1)^2$		6
Content IV							$(1)^1$	$(1)^2$											3
Subtotal	2			2	4		3	6			2				4		2		
Total	2			6			9			2			4			2			

O- objective type question SA –short answer type

Analysis and interpretation of data

Table 6

Scores of achievement test in frequency table

score	Number of students
0-5	0
5-10	6
10-15	6
15-20	14
20-25	16

Table 7

Arithmetic mean

Class interval	Frequency f	Midvalue x	fx
0-5	0	2.5	0
5-10	6	7.5	45
10-15	6	12.5	75
15-20	14	17.5	245
20-25	16	22.5	360
	42		∑fx 725

Arithemetic mean $\frac{\sum fx}{N}$ $\frac{725}{42} = 17.26$

Table 8

Standard deviation

Class interval	Frequency f	Midvalue x	x^2	fx^2	fx
0-5	0	2.5	6.25	0	0
5-10	6	7.5	56.25	337.5	45
10-15	6	12.5	156.25	937.5	75
15-20	14	17.5	306.25	4287.5	245
20-25	16	22.5	506.25	8100	360
	42			$\sum fx^2 =$ 13662.5	$\sum fx = 725$

$$\text{standard deviation} = \sqrt{\frac{13662.5}{42} - \frac{[725]^2}{[42]}}$$

$$= 325.29 - (17.26)^2$$

$$= 325.29 - 297.90$$

$$= \sqrt{27.39}$$

$$= 5.23$$

Table 8 and 9 reveals that the mean and standard deviation of the overall performance in the achievement test for the entire sample were 17.26 and 5.23 respectively.

Above average = mean + standard deviation

= 17.26+ 5.23

= 22.49

Below average = mean- standard deviation

= 17.26-5.23

= 12.03

Average = In between above average & below average

Between 12.03 and 22.49

Twelve students were in above average, three students were in below average and twenty seven students were in average group.

Table 9

Correlation between logical mathematical intelligence and achievement test in Mathematics

Sl no	Logical mathematical intelligence	Academic achievement	r_1	r_2	D r_1-r_2	D^2
1	74	17	26.6	32.5	-5.9	34.81
2	80	22	14.8	8.5	6.3	39.69
3	65	15	35	35.5	-.5	.25
4	81	22	10	8.5	1.5	2.25
5	79	22	19.5	8.5	11	121
6	73	18	29	28.5	.5	.25
7	85	23	4	4	0	0
8	64	14	37	39	-2	4
9	74	18	26.6	28.5	-1.9	3.61
10	79	19	19.5	24.5	-5	25
11	80	20	14.8	20.5	--5.7	32.49
12	87	23	3	4	-1	1
13	81	21	10	15	-5	25
14	50	9	38.5	41	-2.5	6.25
15	80	22	14.8	15	-.2	.04
16	79	21	19.5	15	4.5	20.25

17	72	17	31	32.5	-1.5	2.25
18	75	18	25	28.5	-3.5	12.25
19	77	19	24	24.5	.5	.25
20	83	22	6	8.5	-2.5	6.25
21	100	25	1.5	1.5	0	0
22	70	16	38.5	40	-1.5	2.25
23	33	6	6	42	-36	1296
24	69	16	33	35.5	-2.5	6.25
25	79	20	19.5	20.5	-1	1
26	100	25	1.5	1.5	0	0
27	50	11	38.5	40	-1.5	2.25
28	83	21	6	15	-9	81
29	80	20	14.8	20.5	-5.7	32.49
30	81	22	10	8.5	1.5	2.25
31	74	17	26.6	32.5	-5.9	34.81
32	82	21	8	15	-7	49
33	66	17	34	32.5	1.5	2.25
34	85	23	14.8	4	10.8	116.64
35	80	22	14.8	8.5	6.3	39.69
36	78	21	22.5	15	7.5	56.25
37	73	19	29	24.5	4.5	20.25
38	83	21	6	15	-9	81
39	65	15	35.5	35.5	0	0
40	73	19	29	24.5	4.5	20.25
41	78	18	22.5	28.5	-6	36
42	80	20	14.8	20.5	-5.7	32.49

Correlation between logical mathematical intelligence and achievement test

$$= \frac{1- 6 \sum D^2}{n(n^2 -1)}$$

$$= 1- \frac{6X 2249.01}{42(42^2- 1)}$$

$$= 1- \frac{13494.06}{74046}$$

$$= 1-.18$$

$$= .82$$

Inference

From this study the Investigator can find out a co-efficient of correlation with a value of 0.954 by the Spearman method. It is clear that this shows a positive correlation between the logical mathematical intelligence and academic achievement in mathematics.

Summary, suggestion and conclusion

Main findings and conclusion

The mean of logical mathematical intelligence (75.7) were found to be high

The mean of academic achievement in mathematics(17.26) were found to be high

There exist a high correlation (.82) between the logical mathematical intelligence and academic achievement in mathematics of standard IX students

Suggestion

The present study conducted only in one school. A similar study may also be conducted in another schools.

It is necessary for mathematics curriculum developers to integrate logical mathematical intelligence into school curriculum of secondary school.

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