Scholarly Research Journal for Humanity Science & English Language,
Online ISSN 2348-3083, SJ IMPACT FACTOR 2019: 6.251, www.srjis.com
PEER REVIEWED & REFEREED JOURNAL, FEB-MAR, 2021, VOL-9/44

A STUDY OF MATHEMATICAL APTITUDE IN RELATION TO INTELLECTUAL ABILITIES OF SECONDARY LEVEL STUDENTS

Vidhi Dhoundiyal[1], Ph. D. & Savita Rawat[2], Ph. D.

[1]Assistant professor, Department of Education (B. Ed), Govt. P.G. College Gopeshwar Chamoli

[2]Associate professor, Department of Education (B. Ed), D.A.V. (P.G) College Dehradun

Paper Received On: 25 MAR 2021

Peer Reviewed On: 30 MAR 2021

Published On: 1 APRIL 2021

Content Originality & Unique: 94%

Abstract

Mathematical Aptitude in real terms cannot be confided to mere computational abilities; rather it is a high ability to think and work abstractly with the mathematical patterns and sort out mathematical relationships. On the other hand General Intelligence which according to Gardner, calls for a critical thinking, logical reasoning and Information Processing seems to play a significant role in determining the Mathematical Aptitude of an individual. Thus the study aimed to find out the Mathematical Aptitude of an individual in relation to his Intellectual Abilities. A sample of 600 students was taken from various educational blocks of Dehradun District (Uttarakhand) by Purposive-multistage-random sampling technique. Eventually, this study reveals that Mathematical Aptitude is an inborn construct not strictly independent and to some extent it is subjected to environmental influences and Intellectual ability of an individual. The findings also ascertain either a high or a moderate positive correlation between IA and MA (along with all its five dimensions).

Keywords: *Mathematical Aptitude (MA), Intellectual Ability (IA), Secondary level Students*

Scholarly Research Journal's is licensed Based on a work at www.srjis.com

Introduction

Mathematics has made our life more systematic and organized and plays an indispensible role in shaping our mind and behavior, yet it is not a subject of choice for many students. Many people believe that there are only few "gifted" individuals who have an element that help them to learn mathematics, and that hard work cannot compensate for this. This specific element works through the process of induction and deduction and is a logical entity which initiates with a specified data, apply suitable reasoning and arrive at a conclusion. This indicates towards his innate tendency to think mathematically, which we term as Mathematical Aptitude. This view point reveals that having high Mathematical Aptitude is somewhat different from scoring good marks in mathematics.

Copyright © 2021, Scholarly Research Journal for Humanity Science & English Language

The abstract nature of mathematics, asserts that tackling or comprehending mathematical Problems requires development of various mental faculties pertaining to a person's Intellectual Ability. Confining our focus on the Thurston's **Number factor (N) ability** and Gardner's **logical/ mathematical ability**, we infer that both of these intellectual abilities accounts for the individual's competence in mathematics. We also know that ***aptitudes are interchangeable with abilities, as aptitude is a psychological trait that includes a specific collection of independent mental abilities in an explicit cognitive domain of an individual predicting his success in a particular area.*** Similarly, Intelligence is also a comprehensive cognitive trait that governs all the mental abilities. Therefore it can be conceived that the measure of Intellectual ability may be directly proportional to the mathematical aptitude of a person. Contrary to this, it has also been observed that the children with high Intelligence Quotient (IQ) no matter however high, are not mathematically talented. ***Analysis of thisdisparity reveals that Mathematical talent is a specific aptitude, while an IQ score is a combined outcome of many different aptitudes and abilities.*** **Gehlawat, M. (2011)** also traced that there is a moderately positive and significant relationship between Mathematical Aptitude and intelligence of class V students. **Upadhayay, H. & Ramtek, V. (2005)** found a significant effect of Intelligence on the abilities of *Concrete Operational Stage i.e.conservation ability on number, quantity, length, mass and weight of* the students. **Rajyaguru, M.S. (1991)** found that there was a positive and a significant correlation between Intelligence and Numerical Aptitude. All these studiessuggest that General intelligence seems to have a considerable impact on the trait Mathematical aptitude.

Question arises as to what relationship exist between the Mathematical Aptitude, and Intellectual Ability and how far are they correlated?

Objectives:

1. To find out whether different levels of Intellectual Ability have any impact in the generation of Mathematical Aptitude of secondary level students.
2. To find out the relationship of Mathematical Aptitude with Intellectual Ability.

Hypothesis:

1. There exists no significant difference between Mathematical Aptitude of students with different Intellectual Ability level.
2. There is no significant correlation between Mathematical Aptitude and Intellectual Ability.

Copyright © 2021, Scholarly Research Journal for Humanity Science & English Language

Research Design:

The study was carried on the secondary level students wherein the Intellectual ability varied in three ways High, Average and Low.The population constitutes the students studying in all types of (Government and Public) senior secondary schools regulated under various boards like Uttarakhand Board, CBSE Board and ICSE Board falling under the six educational blocks of Dehradun.A sample of 600 students was taken by Purposive- multistage – random sampling technique**.**In order to find out the impact of (High, Average and Low) Intellectual on Mathematical Aptitude one way ANOVA was implemented. The General Mental Ability Test by Dr. S.S. Jalota was used to measure the Intellectual Ability (IA) of the students while the Mathematical aptitude Test (MAT) was prepared by the researcher herself which was evaluated through its 5 dimensions viz. Numerical Ability (NA), Numerical Reasoning (NR), Ability to use Symbols (AUS), Spatial Ability (SA), Abstract Reasoning (AR). The test had reliability r11= 0.83801and the constructive validity as determined by Factor Analysis technique indicated that the factor loadings of all the five dimensions are considerably high i.e. 0.6.

Research Findings:

1. **DISTRIBUTION OF STUDENTS AND THEIR MEAN IN VARIOUS INTELLECTUAL ABILITY LEVELS**

Table: 1 Mean of students' Intellectual Abilities

IA Levels	N(600)	Mean	S.D
HIAL	197	83.47716	3.894767
AIAL	369	65.77507	7.726
LIAL	34	38.29412	5.55703

HIAL: High Intellectual Ability Level, AIAL: Average Intellectual Ability Level, LIAL: Low Intellectual Ability Level

The results of our study reveal that a large part of our sample lies in average IA level. A maximum percentage of the students belonged to Average IA level (61.5 %,) followed by High (32.6%) and then low (5.66%) IA levels. The mean IA score in these levels were 65.77, 83.47, and 38.29 respectively.

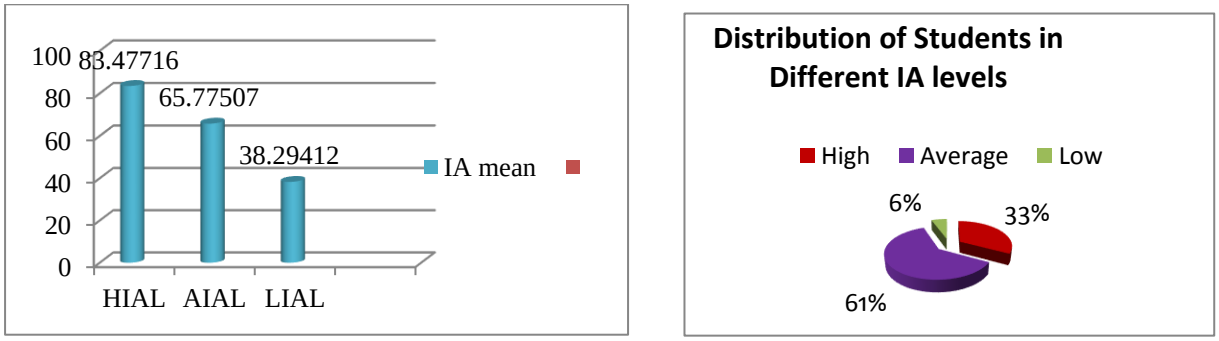

Fig: 1Percentage Distribution &Mean of students in different IA Levels

Copyright © 2021, Scholarly Research Journal for Humanity Science & English Language

2. A STUDY OF IMPACT OF INTELLECTUAL ABILITY (IA) ON STUDENTS' MATHEMATICAL APTITUDE (MA) AND ITS VARIOUS DIMENSIONS

(A) Impact of Intellectual Ability on 'Numerical Ability'

Table- 2.1 Comparison of mean NA scores of students having different IA

IA Level	N	Mean	S.D
High	197	6.63	2.32
Average	369	5.02	1.76
Low	34	3.11	1.64

Summary: Analysis of Variance

Source of Variation	S.S	M.S	Df	F	P
Between groups	530.57	265.28	2	69.04**	0.00
Within groups	2293.72	3.84	597		

NA=Numerical Ability, IA= Intellectual Ability, *= significance of 0.05 level; ** = significance at 0.01 level

It states that there is a significant difference in the Numerical Ability possessed by students when categorized on the basis of different IA levels.It was also confirmed that the students belonging to HIAL, AIAL and LIAL also differ significantly from each other.

(B) Impact of Intellectual Ability on 'Numerical Reasoning'

Table- 2.2 Comparison of mean NR scores of students having different IA

IA Level	N	Mean	S.D
High	197	3.26	1.28
Average	369	2.74	1.35
Low	34	1.17	0.96

Summary: Analysis of Variance

Source of Variation	S.S	M.S	Df	F	P
Between groups	132	66.35	2	38.485**	0.00
Within groups	1029	1.72	597		

NR=Numerical Reasoning, IA = Intellectual Ability, *= significant at 0.05 level; **= significant at 0.01 level

Table2.2 reveals that Numerical Reasoning of students differs significantly in different IA levels. This difference in mean NR score is significant for all the three levels i.e. HIAL, AIAL and LIAL.

Copyright © 2021, Scholarly Research Journal for Humanity Science & English Language

(C) Impact of Intellectual Ability on 'Ability to use symbols'

Table- 2.3 Comparison of mean AUS scores of students having different IA

IA Level	N	Mean	S.D
High	197	2.56	1.08
Average	369	2.04	0.97
Low	34	1.41	0.89

Summary: Analysis of Variance

Source of Variation	S.S	M.S	Df	F	P
Between groups	55.65	27.82	2	27.37**	0.00
Within groups	606.9	1.01	597		

AUS=Ability to use symbols, IA= Intellectual Ability, *= significant at 0.05 level; ** = significant at 0.01 level

All the three IA levels differed significantly on AUS so the IA level do bear a significant impact in determining a person's AUS. Moreover the AUS of students falling in the three different IA levels are significantly different from each other.

(D) Impact of Intellectual Ability on 'Abstract Reasoning'

Table- 2.4 Comparison of mean AR scores of students having different IA

IA Level	N	Mean	S.D
High	197	6.6	2.56
Average	369	4.78	2.28
Low	34	3.11	2.05

Summary: Analysis of Variance

Source of Variation	S.S	M.S	Df	F	P
Between groups	598.03	299.015	2	53.33**	0.00
Within groups	3347.08	5.607	597		

AR= Abstract Reasoning, IA= Intellectual Ability, *= significant at 0.05 level; ** = significant at 0.01 level

The AR score sustains a significant difference when students are categorized on the basis of IA.Further theAR scores of the students falling in the three IA levels sustain a significant difference from each other.

(E) Impact of Intellectual Ability on Spatial Ability (SA)

Table- 2.5 Comparison of mean SA scores of students having different IA

IA Level	N	Mean	S.D
High	197	3.67	1.41
Average	369	2.85	1.48
Low	34	1.17	1.14

Copyright © 2021, Scholarly Research Journal for Humanity Science & English Language

Summary: Analysis of Variance

Source of Variation	S.S	M.S	Df	F	P
Between groups	210.62	105.31	2	50.66**	0.00
Within groups	1240.95	2.079	597		

SA=Spatial Ability, IA= Intellectual Ability, *= significant at 0.05 level; ** = significant at 0.01 level

The IA level do bear a significant impact in determining a person's SA. Further the SA scores of students in all the three IA levels differed significantly from each other on their mean SA score.

Table: 2.6

Impact of Intellectual Abilities on 'Total Mathematical Aptitude'

Comparison of mean TMA scores of students having different IA

IA Level	N	Mean	S.D
High	**197**	**22.72**	**6.42**
Average	**369**	**17.46**	**4.96**
Low	**34**	**10**	**3.71**

Summary: Analysis of Variance

Source of Variation	S.S	M.S	Df	F	P
Between groups	6322.54	3161.27	2	107.126**	0.00
Within groups	17617.32	29.51	597		

TMA=Total Mathematical Aptitude, IA= Intellectual Ability, *= significant at 0.05 level; ** = significant at 0.01 level

The mean MA score in the HIAL, AIAL and LIAL reveals that there is a strong impact of IA level on the MA of a person. We can hereby infer that the IA level do bear a significant impact in determining a person's Mathematical Aptitude (MA). Moreover the students falling in these three IA levels (High Average and Low) differed significantly from each other on their Mathematical Aptitude (MA).

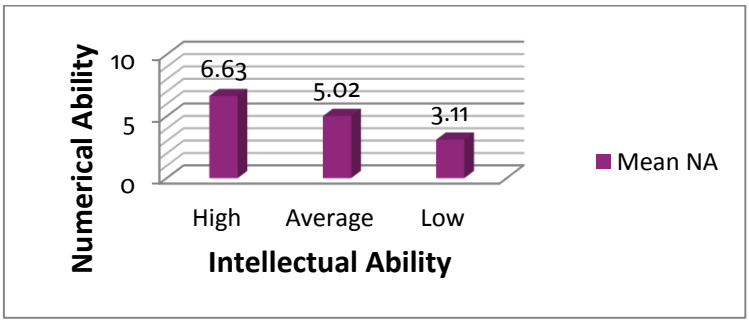

Fig. 2.1 Comparison of mean NA scores of students having different Intellectual Abilities

Copyright © 2021, Scholarly Research Journal for Humanity Science & English Language

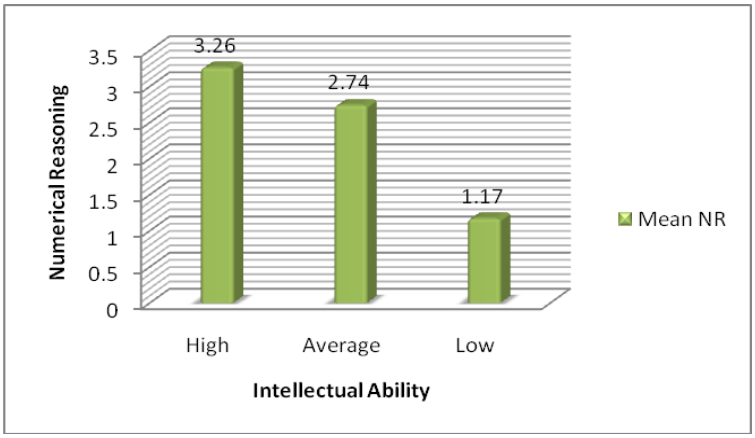

Fig. 2.2 Comparison of mean NR scores of students having different Intellectual Abilities

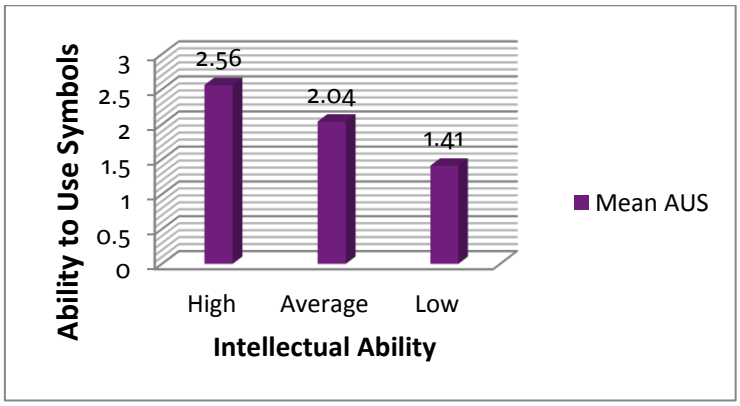

Fig. 2.3 Comparison of mean AUS scores of students having different Intellectual Abilities

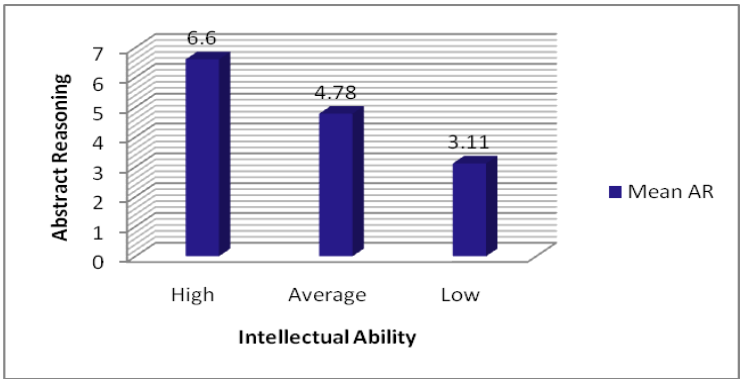

Fig. 2.4 Comparison of mean AR scores of students having different Intellectual Abilities

Copyright © 2021, Scholarly Research Journal for Humanity Science & English Language

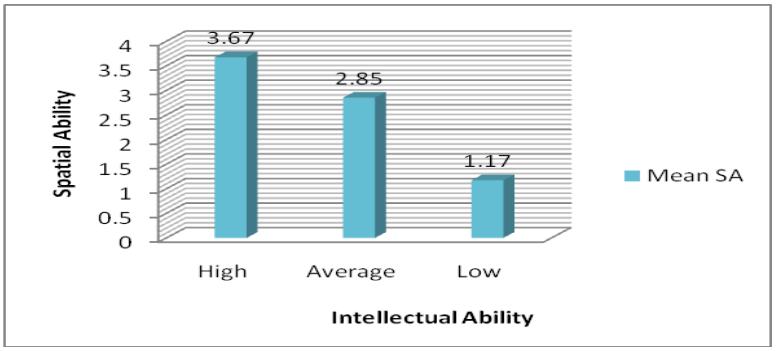

Fig. 2.5 Comparison of mean SA scores of students having different Intellectual Abilities

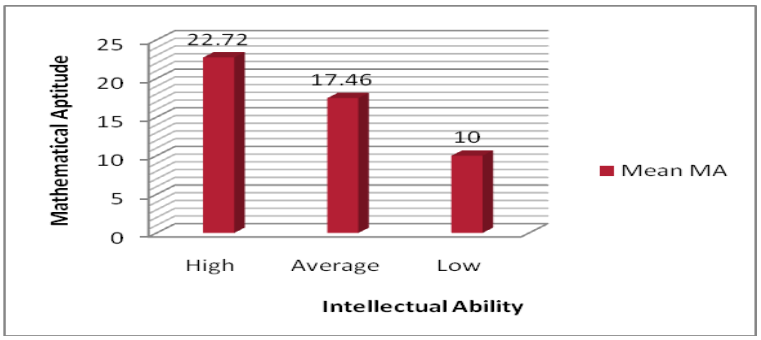

Fig. 2.6 Comparison of mean Mathematical Aptitude scores of students having different Intellectual Abilities

3. Correlation between Mathematical Aptitude and Intellectual Ability of Secondary level students

Table: 3

Variable	NA	NR	AUS	AR	SA	TOTAL MA	IA
NA	1.00	0.41**	0.41**	0.47**	0.44**	0.80***	0.47**
NR		1.00	0.35*	0.32*	0.38*	0.64***	0.38*
AUS			1.00	0.25*	0.34*	0.57**	0.30*
AR				1.00	0.35*	0.76***	0.49**
SA					1.00	0.68***	0.44**
TOTAL MA						1.00	0.60**
PS							0.53**
IA							1.00

*= Low Positive Correlation, **=Moderate Positive correlation, ***= High Positive Correlation

(A) Correlation of Numerical Ability with MA and IA

Copyright © 2021, Scholarly Research Journal for Humanity Science & English Language

I.NA is found to have **highly significant positive** correlation (ρ = 0.80) with the **Total mathematical aptitude (TMA**) and a moderate correlation is traced with the other four dimensions.

(ii) Correlation of NA with IA (ρ =0.47) also reveals a **moderate** positive correlation between them.

(B) Correlation of Numerical Reasoning with MA and IA

(i) NR also exhibit a **high positive** correlation with TMA (**0.64**) and a **low positive** correlation with the other dimension of MA test.

(ii) NR also shows a comparatively **low positive correlation** with IA (**ρ =**0.38)

(C) Correlation of 'Ability to use Symbols' with MA and IA

(i) AUS shows a **high** positive correlation with TMA (0.57) but regarding its other two dimension i.e. AR (p = 0.25) and SA (p = 0.34) the correlation is found to be comparatively low but positive.

(ii) Regarding the relation of AUS with IA we again trace a **low and positive correlation** (**ρ =** 0.30).

(D) Correlation of Abstract Reasoning with MA and IA

(i) AR shows a **highly positive correlation**with TMA (**ρ =** 0.76), while a low positive correlation is shown with SA (**ρ =** 0.35).

(ii) The correlation of AR with the independent variables reveals **a moderate positive correlation** with both **IA (ρ =0.49**

(E) Correlation of Spatial Ability with MA and IA

(i) SA shows high positive correlation with TMA score (**ρ** = 0.68) and a moderately positive correlation with other dimensions of MA.

(ii) It is further observed that IA (**ρ** = 0.44) shows a low positive correlation with SA.

(F) Correlation between TMA and IA

We observe a **high positive correlation** (**ρ** =0.60) exist between MA and IA. This result has also been supported by **Pandey (1980)** and **Gehlawat, M. (2011)** who found a positive and significant correlation between Mathematical Aptitude and Intelligence. It is because high MA of an individual helps him to indulge in cognitive activities to an advanced level as compared to a child who resist from mathematical thinking.

Copyright © 2021, Scholarly Research Journal for Humanity Science & English Language

Conclusion:

Eventually, the study reveals that MA is an inborn construct not strictly independent and to some extent it is subjected to environmental influences. The tasks harnessing IA provides a positive impetus to restructure the MA of an individual. The findings also reveal that Mathematical aptitude can be nurtured and its level can be varied through conducible environmental situations (as a significant difference was found between Government and public school students). Therefore efforts must be made on the part of educationist at all levels i.e. planning, execution and evaluation that the students may get adequate experiences to bring out his best.

The tasks of harnessing the Intellectual Ability provide a positive impetus to restructure the Mathematical Aptitude of an individual. Thus, a constant and global effort is needed to establish Mathematical Aptitude as an independent clinical identity, to develop effective measures to bring change in the intellectual insight regarding this innate ability and ensure its proper diagnosis and nurture it to its excellence. An awareness regarding the impact of various environmental and psychological factors affecting it must be accelerated so that the child may be protected from perceiving this area as a lifeless and a mechanical process and thereby prevent him from developing an anxiety, fear or disinterest in this area.

References:

Das, J.P. (1988) "The essence of Human intelligence"Indian Education Review, Vol. 23(2) 32-46, V Survey, Vol. 2, pp 983

*Gehlawat. M. (2011) "Mathematical Aptitude and Intelligence of Class V Students In Relation To Their Demographic Variables" International Referred Research Journal,July,2011,ISSN-0975-3486, RNI: RAJBIL 2009/30097, VOL-II *ISSUE 22Genderhttp://en.wikipedia.org/wiki/Genders#Biological_factors_and_views.*

Guilford , J.P. (1967) "The Nature of Intelligence" Published by: Mc. Graw Hill, New York.

J.P. Guilford(1967) "The Nature of Intelligence", McGraw-Hill, New York , 1967.

Rajyaguru, M. S.(1991) "A comparative study of over and underachievers in mathematics" V Survey of Educational Research 1988-92, Vol. 2, New Delhi, N.C.E.R.T,1290.

Sumangala, V. (1995) "Some Psychological Variables Discriminating Between High and Low Achievers in Mathematics Experiments in Education", 23 (10-11) Sixth Survey of Educational Research, 1993- 2000. Vol. II, pp. 165- 175.

Updhayay,H. and Ramtek,V (2005) "Impact of Intelligence on Concrete Operational Stage of Cognitive Development"Psycho –lingua (ISSN:0377-3132), 2005,35(1):15-17, Psycho linguistic Association of India.

Yadav,(1984) "Research in Mathematics Education A Trend Report"Mohammad Miyan p. 2 http://www.education.nic.in/cd50years/g/Z/9I/0Z9I0G01.html

Copyright © 2021, Scholarly Research Journal for Humanity Science & English Language