Spatial Ability of High school Students as Predicators of Achievement in Mathematics

Seema Taneja

PHD scholar (Education Deptt) MDU Rohtak

Dr. Pragya Aggarwal

Principal Hindu College of education Sonipat

Abstract:

The present study was established to examine the effect of spatial ability of high school students as predictors of mathematics achievement. A sample of 500 students were selected randomly and stratified in to locale, gender and type of schools from Palwal distt. Haryana. A test made by Pillai&Nair from Kerela university (1968) was employed with three three levels Block counting, Figure Rotation and Paper form board. The analysis was done by correlation n t-test.The findings suggested that there was a significant correlation in urban and rural areas.In block counting and figure rotationBoys perform better but in paper form board girls do better.

Introduction

Different civilization contributes immensely towards the development of mathematics. Sumerian civilization has enriched the granary of mathematical knowledge through their hexadecimal system and cuneiform writing. It has also considered the importance of mathematics in general education and suggest that "Mathematics should be visualized as the vehicle to train a child to think, reason," analyze and to articulate logically a part from being a specific subject. It should be treated as concomitant to any subject in evolving analysis and reasoning"

Mathematics offers a way of doing things, to be able to solve mathematical problems and more generally, to have the tight attitude for problem solving and to be able to approach all kinds of problems in a systematic manner. The world today is witnessing developments and changes coming too fast, demanding immediate attention. Every learner in a dynamic learning society has to be

familiar with such areas of knowledge, in various disciplines in the global context. Education must facilitate learner's personal growth and psychologically equip them to cop with the rapid changes taking place in all spheres of life. Thus the focus of education is moving away from providing mere cognitive skills to preparing students to face the challenges of life. It is in this context, the theories of constructivism and multiple intelligences influence the process of education and gain much relevance.

Constructivist education with all its strength and limitation, proclaims a tool in hand that not only meets the pragmatic needs of education, but also extends the operational boundaries of teaching and learning to register qualitative advance on run-of-the mill function of education at different levels.

Multiple Intelligence:

The theory of multiple intelligences is a theory of intelligence that differentiates it into specific (primarily sensory) 'modalities', rather than seeing intelligence as dominated by a single general ability. This model was proposed by Howard Gardner in his 1983 book Frames of Mind: The Theory of Multiple Intelligences. Gardner articulated eight criteria for a behavior to be considered an intelligence.[1] These were that the intelligences showed: potential for brain isolation by brain damage, place in evolutionary history, presence of core operations, susceptibility to encoding (symbolic expression), a distinct developmental progression, the existence of savants, prodigies and other exceptional people, and support from experimental psychology and psychometric findings.

Gardner chose eight abilities that he held to meet these criteria:[2] musical–rhythmic, visual–spatial, verbal–linguistic, logical–mathematical, bodily–kinesthetic, interpersonal, intrapersonal, and naturalistic.

Here the researcher is taking spatial intelligence as one of the variables.

Though a large number of researchers have recognized the importance of spatial intelligence the remarkable contributions are those made by Piaget, who spoke of the sensory-motor understanding of space which emerges during infancy. The two abilities which are complementary- the initial appreciation of the trajectories observed in objects and the eventual capacity to find one's way between various locales- account for spatial intelligence.

Learning takes place from the moment a child is born and is the result of various influences and stimuli. These influences and stimuli provide the impulse for mental activity, Much learning takes place in the first few years of child‘s life, long before they start formal schooling. They listen, they hear sounds and the rhythm of the sounds becomes meaningful,

Mathematics is built on certain postulates, axioms and concepts which are interrelated in such a way that building up of larger concepts are impossible without the knowledge of fundamental concepts, facts, relations and principles. It is generally accepted that in the teaching-learning process of mathematics, more emphasis should be given on the understanding of basic principles and concepts, than on the mechanical learning of mathematical computations. But our schools and culture focus most of their attention on reasoning ability and logical-mathematical intelligence.

With varying degrees of conviction many explanations are offered for these individual variations. These explanations are offered from experience and assessment of relevant factors. They are not, for that reason, wrong, although some of them have no concrete foundations. It cannot be taken for granted that these explanations are true in their entireties and clear conclusions cannot yet be reached. Much of the researches in this area are centered on some basic questions connected with human abilities, educational talent, intelligence and such general dimensions and general scholastic achievement. Even the important studies conducted by western researchers, did not cover all the dimensions of this problems. Studies of this kind conducted by Indian researchers are few.

Achievement differences in complex subject areas like mathematics have not been adequately explained Solving a mathematical problem for example, implies the interaction of varied abilities like comprehension of the process implied, inductive and deductive reasoning, and abilities to deal with abstract concepts, spatial and visual perception and interpretation, and so on. Of the many factors proposed to account for individual variations in mathematics achievement, the present study concentrates on mental abilities related to spatial intelligence and "visual perception.

Objectives of the Study

- To find out the interrelationship between Spatial Ability and Mathematics Achievement taken in pairs for the whole sample and relevant sub-sample.
- To find out interrelationship between Mathematics Achievement and Each of the independent variables when effect of other variables is paralleled out.

Hypotheses

There is no significant relationship between spatial ability, and mathematical achievement of high school students.

Definition of terms

Spatial ability

Spatial ability denotes the ability to judge the relations of objects in space, to manipulate them mentally, to visualize the effect of putting them together or of turning them over or around.

Predictors

Something such as an event or fact that enables to say what will happen in future.

Variables of the Study

Spatial Ability Variables

1. Spatial Ability 1 (Block Counting)
2. Spatial Ability2 (Figure Rotation)
3. Spatial Ability 3 (Paper from Board)

Sample

The data required for the study were collected from a sample of 500 students studying in class IX of selected schools Palwal. The Sample was selected techniques with representation given to factors like school efficiency, rural-urban residence of subjects, sex of subjects, and type of school.

Tool Used For the Study

The data for the study has been obtained using the following tools.

I. Achievement test in Mathematics

II. Spatial Ability Test

Analysis:

Coefficients Of Correlation Betweenspatial Ability and Mathematics Achievement for The Whole Samle

DIMENSION	GENDER	MEAN	SD	t-value	INTERPRETATION
Warmth	Male	7.60	2.32	.02	Significant
	Female	6.03	2.03		
Liveliness	Male	5.60	2.07	2.00	Significant
	Female	4.51	1.66		
Social Boldness	Male	6.50	1.51	2.26	Significant
	Female	5.27	1.69		
Tough-Mindedness	Male	4.80	1.48	-2.58	Significant
	Female	5.99	1.45		
Independence	Male	7.20	1.48	3.01	Significant
	Female	5.77	1.47		

From the results it can be concluded that there is significant positive relation between Spatial Ability and Mathematics Achievement.

Coefficients Of Correlation between Spatial Ability and Mathematics Achievement for The Boys

Variables correlated with Mathematics Achievement		Value of r	N
Spatial Ability Total		0.549**	321
Sub-tests of Spatial Ability	Block Counting	0.410**	321
	Figure Rotation	0.427**	321
	Paper From Board	0.400**	321

From the results it can be concluded that there is significant positive relation between Spatial Ability and Mathematics Achievement of boys

Coefficients of Correlation between Spatial Ability and Mathematics Achievement for the Girls

Variables correlated with Mathematics Achievement		Value of r	N
Spatial Ability Total		0.688**	179
Sub-tests of Spatial Ability	Block Counting	0.395**	179
	Figure Rotation	0.530**	179
	Paper From Board	0.633**	179

From the results it can be concluded that there is significant positive relation between Spatial Ability and Mathematics Achievement of Girls

Coefficients of Correlation between Spatial Ability and Mathematics Achievement for the Students Studying In Urban Area

Variables correlated with Mathematics Achievement		Value of r	N
Spatial Ability Total		0.598**	276
Sub-tests of Spatial Ability	Block Counting	0.428**	276
	Figure Rotation	0.445**	276
	Paper From Board	0.495**	276

From the results it can be concluded that there is significant positive relation between Spatial Ability and Mathematics Achievement of students studying in urban area

Coefficients of Correlation between Spatial Ability and Mathematics Achievement for the Students Studying In Rural Area

Variables correlated with Mathematics Achievement		Value of r	N
Spatial Ability Total		0.584**	224
Sub-tests of Spatial Ability	Block Counting	0.377**	224
	Figure Rotation	0.445**	224
	Paper From Board	0.464**	224

From the results it can be concluded that there is significant positive relation between Spatial Ability and Mathematics Achievement of students studying in rural area

Coefficients of Correlation between Spatial Ability and Mathematics Achievement for the Students Studying In Government Schools

Variables correlated with Mathematics Achievement		Value of r	N
Spatial Ability Total		0.795**	196
Sub-tests of Spatial Ability	Block Counting	0.664**	196
	Figure Rotation	0.685**	196
	Paper From Board	0.689**	196

From the results it can be concluded that there is significant positive relation between Spatial Ability and Mathematics Achievement of students studying in Government Schools.

Coefficients of Correlation between Spatial Ability and Mathematics Achievement for the Students Studying In Private Schools

Variables correlated with Mathematics Achievement		Value of r	N
Spatial Ability Total		-0.096	304
Sub-tests of Spatial Ability	Block Counting	-0.090	304
	Figure Rotation	-0.165*	304
	Paper From Board	-0.092	304

From the results it can be concluded that there is no significant relation between Spatial Ability and Mathematics Achievement of students studying in Private Schools.

Independent Effect of Sub Tests of Spatial Ability on Mathematics Achievement

Variables	Partial Correlation coefficient	N	Controlled Variables						
Achievement with Block Counting (S1)	0.075	500	P1	P2	P3	P4	P5	S2	S3
Achievement with Figure Rotation (S2)	0.135		P1	P2	P3	P4	P5	S1	S3
Achievement with Paper From Board (S3)	0.164		P1	P2	P3	P4	P5	S1	S2

**significant at 0.01; level *significant at 0.05; level

S1=Block Counting S2=Figure Rotation S3=Paper Form Board

P1=Word Comparison P2=Figure Comparison P3=Comparison of Roman Numerals

P4=Numbers/Formula Comparison P5=Figure Identification

Conclusion:

The study reveals that there is significant positive correlation between the spatial ability and mathematics achievement of the students of high school. Moreover each of the sub components Block Counting, Figure Rotation and Paper form Board of the spatial ability has also significant correlation with Mathematics Achievement.

Boys and Girls

There is significant positive correlation between the spatial ability and mathematics achievement of Boys and Girls. Also each of the sub components Block Counting, Figure Rotation and Paper Board of the Spatial Ability has also significant correlation with the Mathematics Achievement.

Locality

The study reveals that there is significant positive difference between the spatial ability and mathematics achievement of students studying in urban and rural area. Also each of the sub components Block Counting, Figure Rotation and Paper from board of the spatial ability has also significant correlation with the Mathematics Achievement of students of different locality. Thus there is high positive correlation between spatial ability and mathematics achievement for all students irrespective of their residence locality.

Type of School

There is significant positive correlation between the spatial ability and mathematics achievement of students studying in Government and Private schools. Moreover each of the sub components Block counting, Figure Rotation, and Paper from Board of the spatial ability has also significant correlation with the Mathematics Achievement. Thus there is high positive correlation between spatial ability and mathematics achievement for all students irrespective of the type of the school where they are studying.

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