

**A STUDY ON HEMISPHERCITY IN ACTIVATING MATHEMATICAL SKILLS****M.Vijayakumar**

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Abstract

This present study is aim to study, mathematical skills of the pupil in relation to their brain dominance. Knowledge in mathematic related field such as numerical knowledge, arithmetic, graphical & geometric sense etc, are important for any individual for their day to day life. Hence the present study intended to study the mathematical skills of the pupil. Since each individual have their own cognitive level, hence the dominant brain be the factor for their academic performances. So this leads to study the mathematical skills of the pupil in relation to their brain dominance. The human brain divided into two hemispheres, the right & left, they do unique function and also having unique characteristics. All these aspects are considered for the study. By random selection method 190 samples were collected from students of standard IX. From the analysis, the major findings were arrived such as, the Left and Right brainers are differed significantly and the Left brainers are good in Total Mathematical Skills also they performed well in the dimensions viz., Arithmetic & Numerical, Statistical, Mathematical Linguistic, Logical skills. In other hand the Right brainers are good in Geometric skills. Considering right & left brainer in both gender (boys and girls) the left brainers are performed better in total mathematical skills. The relationship also shows that the entire dimension positively correlated with total mathematical skill for both right and left brainers.

Key Words: *Mathematical skills, Right Dominance, Left Dominance, Hemisphercity*



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Introduction

The brain is the crown jewel of the human body and it is the most complex part too, it lying in its bony shell and washed by protective fluid, the brain is the source of all the qualities, behavior, intelligence and skills of an individual. It divided two hemispheres viz. Right hemisphere and Left hemisphere, both performing a fairly distinct set of operations. But they concert with each other and two hemispheres communicate information to each other through the thick corpus callous that connects them. The concept of right brain and left brain thinking developed from the research in the late 1960s of an American psycho-biologist Roger W Sperry. He discovered that the human brain has two very different ways of thinking. The right brain is visual and processes information in an intuitive and simultaneous way. The left brain is verbal and processes information in an analytical and sequential way. Right hemisphere is mainly in charge of spatial abilities, face recognition and processing music. It performs some math, but only rough estimations and comparisons. Also helps us to comprehend visual imagery and make sense of what we see. It plays a role in language, particularly in interpreting context and a person's tone. Left hemisphere is linguistics and scientific oriented. It processes information in a linear, sequential and logical manner, also analytic in nature. Left hemisphere accept reality and go with the rule. Hence the mathematical activities such as using number sequences, handling notation & symbols, and converting word problems to mathematical equation are handled by the left hemisphere.

Functions of the Brain Hemisphere

Right Hemisphere (the representational hemisphere)	Left Hemisphere (the categorical hemisphere)
The right hemisphere controls the left side of the body	The left hemisphere controls the right side of the body
Temporal and spatial relationships	Produce and understand language
Analyzing nonverbal information	Planned and structured
Communicating emotion	Controls feelings

Characteristics of the students' Brain Hemisphere

“Right Brain Students” - Characteristics	“Left Brain Students” - Characteristics
The right side of the brain is best at expressive and creative tasks. Good with people Dreamy, deep in thought & Spontaneous Good on writing fiction, draw, or play music Fun and witty personality Unpredictable Emotional & Philosophical Some students may lose track on time and lose notes	The left side of the brain is best at logical and scientific tasks. Good in mathematics and science Rational and logical Organized Have structured goals Interpret information well Answer questions spontaneously Can listen to a long lecture without losing patience Don't let feelings get in their way

Problem of the study

The problem of the study is **“A Study on Mathematical Skills in Relation to Brain Dominance”**

Need for the Study

Human starts to learn from the womb and it continuous till at the last breath. Each and every step of the life one acquires new knowledge and practices it in various situations, this process of acquiring and practicing new knowledge made them to be skilled one. Hence a skilled person can able to handle new situations easily and effectively.

The brain controls each and every cognitive, kinetic and psychomotor activities of a human. So the brain controls and gives comments simultaneously to one or more parts of our body for accomplish every activity. Hence it's obvious that the activities related to learning such as listening, reading and writing are depends on how our brain perform. Hence brain plays an important role in our learning process.

The left and right hemispheres of our brain process information to carry out different activities, and have natural tendency towards the way of thinking. The speed of processing information differs from person to person, which became our dominant character of the brain. The right brain of the brain focuses on the visual, and processes information in accn intuitive and simultaneous way. It is also is referred as the analog brain. It controls three-dimensional sense, creativity, and

artistic senses. And the left brain referred as the digital brain, it controls reading and writing, calculation, and logical thinking.

Most of the pupil expresses their fear & anxiety towards learning mathematics even at higher class. They have problem with identifying, differentiating and remembering the formulas notation and symbols, also finds difficulty in using at appropriate situation.

Since all the above aspects tell us that, it's teacher's bounden duty to aware of cognitive, psychomotor and affective level of their pupil. According to the strength and weakness of the individual, the teacher should adapt the appropriate teaching - learning method to fulfill the academic needs of them.

Objective of the Study

The objectives of Study are:

To identify the students' brain dominance

To identify the brain's dominance in relation to different mathematical skills.

To study the boy's brain dominance in relation to mathematical skills.

To study the girl's brain dominance in relation to mathematical skills.

To study the association between mathematical skills and brain dominance of the students.

To study the relationship between total mathematical skills and its dimension of the Right brainers.

To study the relationship between total mathematical skills and its dimension of the Left brainers.

Hypothesis of the Study

There is no significant difference between Right and Left brain dominant Boys in their Mathematical Skills.

There is no significant difference between Right and Left brain dominant Girls in their Mathematical Skills.

There is no significant association between Right and Left brain dominant students in their Mathematical Skills.

There is no significant relationship between total mathematical skill and its dimensions of the Right brainers.

There is no significant relationship between total mathematical skill and its dimensions of the Left brainers.

Methodology

Among the different methods of study, normative method is used in this research. Normative survey method describes and interprets the present situation. The investigator used systematic random sampling technique for collecting data from the students of Standard IX belongs to Kancheepuram & Chennai District.

Research Variables used in the Study

The Mathematical Skills which consists of six dimensions viz., Arithmetic & Numerical Skill, Algebraic Skill, Geometrical Skill, Statistical Skill, Mathematical Linguistic Skill, and Logical Skill.

Brain Dominance / Hemispheric

Population of the study

The study compiles 190 samples, and they are collected at random from 12 different schools. Samples were drawn from 9th Std students belongs to, Kancheepuram & Chennai district. Those samples were used for the data analysis.

Tools used

The Mathematical Skills Tool was constructed and validated by the investigator. The questioner consists of 90 items with six dimensions viz., Arithmetic & Numerical Skill, Algebraic Skill, Geometrical Skill, Statistical Skill, Mathematical Linguistic skill and Logical Skill, and each dimension consists of 15 objective type items, each item is provided with four options “a”, “b”, “c” and “d” and hence the respondents allow to choose any one answer, among the four options one will be provided with correct answer.

The Brain Dominance Tool was constructed and validated by the investigator. The questioner consists of 45 items. Each item consists of two statements, the statement “a” represents the characteristics of left brain and statement “b” represents the characteristics of right brain. Hence the respondents allow choosing any one of the statement for each item. The maximum number of “a” or “b” will tell whether they strong with left or right brain

Analysis of Data

Table – 1 Mean and Standard Deviation of Brain Hemisphercity in relation to Mathematical Skills

Research Variable	Right brain			Left brain		
	Mean	SD	Mean percentage	Mean	SD	Mean percentage
Arithmetic & Numerical Skill	9.53	3.4	63.53	10.63	3.65	70.87
Algebraic Skill	9.33	3.60	62.20	9.11	3.18	60.73
Geometrical Skill	10.86	2.59	72.40	10.07	2.84	67.13
Statistical Skill	9.45	2.84	63.00	10.57	3.08	70.47
Mathematical Linguistic skill	9.02	3.09	60.13	9.93	3.25	66.20
Logical Skill	9.07	2.90	60.47	9.98	2.99	66.53
Total Mathematical Skill	57.26	10.29	63.62	60.29	10.60	66.99

The perusal of Table 1 reveals that the Mean and Standard Deviation of the Total Mathematical Skills of Right Brainers for the Entire Sample were 57.26 and 10.29 respectively. And the same for the Entire Sample of Left Brainers were 60.29 and 10.60 respectively.

Table 2 – Differential Analysis of Mathematical Skills in relation to Brain Hemisphere

Research Variable	Right Brain (N = 91)		Left Brain (N = 99)		t value
	Mean	SD	Mean	SD	
Arithmetic & Numerical Skill	9.53	3.4	10.63	3.65	2.15*
Algebraic Skill	9.33	3.60	9.11	3.18	0.44
Geometrical Skill	10.86	2.59	10.07	2.84	2.01*
Statistical Skill	9.45	2.84	10.57	3.08	2.61*
Mathematical Linguistic Skill	9.02	3.09	9.93	3.25	1.98*
Logical Skill	9.07	2.90	9.98	2.99	2.13*
Total Mathematical Skill	57.26	10.29	60.29	10.60	2.00*

* Significant at 0.05 level

From the Table 2, the t- value calculated for Total Mathematical Skill & its dimensions with respect to Brain Hemisphere, it is found that Right and Left hemisphere dominant's differed significantly in Total Mathematical Skills and its entire dimensions except Algebraic Skill.

Table 3 – Mathematical Skills of Boys in relation to Brain Hemisphere

Research Variable	Right Brain Boys		Left Brain Boys		t value
	(N = 41)		(N = 50)		
	Mean	SD	Mean	SD	
Arithmetic & Numerical Skill	9.66	3.70	9.94	3.64	0.36
Algebraic Skill	8.90	3.24	9.28	3.15	0.56
Geometrical Skill	8.59	2.92	11.28	2.12	4.93*
Statistical Skill	8.37	2.91	10.56	2.88	3.59*
Mathematical Linguistic Skill	8.02	2.73	10.76	3.13	4.45*
Logical Skill	8.54	2.47	10.84	3.01	4.01*
Total Mathematical Skill	52.07	11.27	62.66	9.59	4.76*

**** Significant at 0.05 level**

From the Table 3, the t- value calculated for Total Mathematical Skill and its dimensions with respect to Boy's brain dominance, it is found that Right and Left brainer boys differed significantly in Total Mathematical Skill and its entire dimensions except two dimensions viz., Arithmetic & Numerical Skill and Algebraic Skill.

Table 4 – Mathematical Skills of Girls in relation to Brain Hemisphere

Research Variable	Right Brain Girls		Left Brain Girls		t value
	(N = 47)		(N = 52)		
	Mean	SD	Mean	SD	
Arithmetic & Numerical Skill	9.90	3.24	8.60	3.03	2.05*
Algebraic Skill	9.97	3.40	8.58	3.31	2.06*
Geometrical Skill	9.93	3.02	8.77	2.48	2.08*
Statistical Skill	8.05	3.01	10.69	2.60	4.65**
Mathematical Linguistic Skill	8.04	3.36	10.72	3.40	3.94**
Logical Skill	8.01	2.82	10.97	2.72	5.30**

Total Mathematical Skills	53.90	12.20	58.34	8.55	2.07*
** Significant at 0.01 level		* Significant at 0.05 level			

From the Table 4, the t- value calculated for Total Mathematical Skill and its dimensions with respect to Girl’s brain dominance, it is found that Right and Left brainer Girls differed significantly in Total Mathematical Skill and its entire dimensions.

Table 5 – Association between Total Mathematical Skills and Brain dominance

Variable		Brain Dominance			Chi square	df	Contingency Coefficient
		Right	Left	Total			
Total Mathematical Skill	Below Average	37	27	64	14.99**	2	0.27**
	Average	21	59	80			
	Above Average	21	25	46			
	Total	79	111	190			

**** Significant at 0.01 level**

From the Table 5, the calculated Chi-square and Contingency coefficient for Total Mathematical Skill and Brain dominance shows that the right & left dominant brainers associate significantly with their levels of Mathematical Skill.

Table 6 – Relationship between Total Mathematical Skills and its dimension of Right Brainers

Total Mathematical Skills	Right Brainers	
Vs	Correlation Value (r)	Remark
Arithmetic & Numerical Skill	0.605**	Marked Correlation
Algebraic Skill	0.588**	Marked Correlation
Geometrical Skill	0.581**	Marked Correlation
Statistical Skill	0.661**	Marked Correlation
Mathematical Linguistic Skill	0.536**	Marked Correlation
Logical Skill	0.701**	High Correlation

**** Significant at 0.01 level**

From the Table 6 it was found that the right brainers are positively correlated in Total Mathematical Skill with its entire dimensions.

Table 7 – Relationship between Total Mathematical Skills and its dimension of Left Brainers

Total Mathematical Skills Vs	Left Brainers	
	Correlation Value (r)	Remark
Arithmetic & Numerical Skill	0.521**	Marked Correlation
Algebraic Skill	0.566**	Marked Correlation
Geometrical Skill	0.603**	Marked Correlation
Statistical Skill	0.536**	Marked Correlation
Mathematical Linguistic Skill	0.535**	Marked Correlation
Logical Skill	0.614**	Marked Correlation

**** Significant at 0.01 level**

From the Table 7 it was found that the left brainers are positively correlated in Total Mathematical Skill with its entire dimensions.

Findings

The mean percentage of total mathematical skill reveals that left brainers scores more than that of right brainers

Analyzing mathematical skills with respect to Brain dominance shows that, total mathematical skill and all its dimensions differed significantly expect the dimension Algebraic skill. Also it shows that Left brainers scores more in total mathematical skill and four of its dimension viz., Arithmetic & Numerical Skill, Statistical Skill, Mathematical Linguistic Skill, Logical Skill. And Right brainers' scores more in geometric skill.

Analyzing mathematical skills with respect to boys' Brain dominance, the Left dominant boys are significantly differed with right dominant boys in total mathematical skill and four of its dimensions viz., Geometrical Skill, Statistical Skill, Mathematical Linguistic Skill, Logical Skill. Also it shows that Left dominant boys score more than that of right dominant boys.

Analyzing mathematical skills with respect to girls' Brain dominance the Left dominant girls are significantly differed with right dominant girls in total mathematical skills and its entire dimension. It shows that Left dominant girls score more than that of right dominant girls in total mathematical skill and three of its dimensions viz., Statistical Skill, Mathematical Linguistic Skill, Logical Skill. Also it shows that Right dominant girls score more than that of Left

dominant girls in three dimensions viz., Arithmetic & Numerical Skill, Algebraic Skill, Geometrical Skill.

The association analysis between levels of mathematical skills and brain dominance show that there is an association between three levels of mathematical skills viz., below average, average and above average with respect to left & right brain dominant students. It shows that 58.42% of students belong to left dominant and 41.58% of students belong to right dominant. It's also reveals that students' who are mathematically skilled i.e. average and above average are belongs to left brain.

From the correlation analysis with respect to right brainers, it is found that there is a significant positive relationship between Total Mathematical Skill and its entire dimensions. It's also found that, with respect to left brainers it is found that there is a significant positive relationship between Total Mathematical Skill and its entire dimensions.

Discussion

From the mean percentage it's clear that the left brainers good in handling Arithmetic & Numerical, Statistical, Mathematical Linguistic and Logical problems, also the right brainers good in handling Algebraic and Geometric problems.

The differential analysis on brain dominance shows that the left brainers strong in doing Arithmetic & Numerical, Statistical, Mathematical Linguistic and Logical problems, same for the right brainers in Geometric problems. From the gender analysis it reveals that left dominant boys & girls better in Statistical, Mathematical Linguistic and Logical problems. Also the right brainer girls are better in Arithmetic & Numerical, Algebraic and Geometrical problems, in other hand the left brainer boys good in Geometrical problems. Based on the students' three levels of the mathematical skill, there is an association with brain dominance, it's also clear that the students' whose mathematical skill level is average and above average are belongs to left dominant.

From the correlation analysis with respect to brain dominance shows that, both right and left dominant students in total mathematical skills with its entire dimensions are positively correlated hence the six dimensions contribute to the total mathematical skills positively.

Exploring the results of the present study shows that the characteristics of the brain reflect on the result. Since the left brain is sequencing, analytic and logical in nature, the left brainers good in doing, number sequencing, word problem and also logical problems. In other hand the

characteristics of right brain such as spatial sense and sketching ability lead right brainers to do well in geometric problems. Since most of the mathematical concepts are the components of the left brain's characteristics. It is strongly reflected in the result, that the total mathematical skill and most of the components lies in the left brain, hence from the results it is concluded that the left brainers are good in mathematical skills.

Educational Implication

Since both sides of the brain perform uniquely and one side may be dominant. The right brain is considered as a *simultaneous processor*. It prefers to learn beginning with the general concept and then going on to specifics also holistic / global in approach. The left brain is considered as a successive processor. It prefers to learn in a step-by-step sequential format, beginning with details leading to a conceptual understanding of a skill also analytic in approach.

In a classroom, with cognitive level students are not a homogenous learning group. They are with various cognitive, affective and psychomotor levels. Also everyone have their own level of understanding, retaining and responding. Hence for every teacher, it is important to understand the characteristics and functions of brain.

From the result it shows that irrespective of the gender, the dominant side of the brain plays an important role. Left brainers are good in mathematics, since it's scientific in nature. The right brainers should given training and adequate practice to activate their left brain to perform in mathematics. Hence for any classroom the teacher should know the dominant side of their students' brain and use appropriate classroom techniques, methods and tools according to them. In other hand the teacher should have awareness towards their own brain dominance, which help them to improve their teaching style and skill.

Conclusion

The school curriculum should facilitate to the development of students' various domains of mind and personality such as intellectual development, emotional development, social development, moral development and aesthetic development. To fulfill that, more than a decade the educators and education policy makers concentrating and insisting on the student – centered approach in teaching & learning. This is to empower pupil and make them a skilled rather than a simply educated. Hence teacher must know about their own pupil's cognitive level and brain dominance, which always useful to work at developing the other hemisphere of them. By

practice it is possible to make two sides of the brain to become specialized, increasing its processing capacity and avoiding situations of conflict where both sides of the brain try to take charge.

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