

Brain Hemisphericity and Learning Style on the Interpretation of Exam Result of the Medical Students

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ABSTRACT

This study examines the relationship between brain hemisphericity, learning style and its effects on examination result among the professional students. The research has been demonstrated the usage of brain hemisphericity and different learning style adopted by the students and how it effects on their examination results. A sample of 100 first to third year medical students including both males and females selected for the study. The data were analysed using Analysis of variance, t' test and correlation test to identify the relationship between the students learning style and their dominant usage of brain hemisphere. The research has demonstrated the importance of brain hemisphericity as it related with learning style. The result of the study reveals that there is a significant relationship between brain hemisphericity and learning style of students. This study also examines the effects of learning style and brain hemisphericity on the interpretation of examination result of the medical students. The research result shows that brain hemisphericity greatly influenced on the examination results. The result of the research will help the teachers and curriculum designers to develop better teaching aids and to incorporate teaching technique's which enhance three types of learning style and to choose an apt method of teaching, based on the usage of brain hemisphericity of the students. Also, assessment of examination result can be modified according to the students learning style and the use of brain hemisphere. A student-centred approach in teaching and learning can inculcate in the educational sector to modified the traditional approach of educational system. Students can identify their learning style and to take appropriate step to enhance other learning styles to improve their academic output.

Keywords: Brain hemisphericity, Learning Style, Examination Result, Psychology of Education Dr. Margaret Francis. Associate Professor, Yenepoya University, Bangalore

INTRODUCTION

Learning is the skill of studying, with the effective use of brain by understanding the theoretical concepts, analysing the facts, connecting with the previous experience and exposure, collecting information and retain it in the memory. Memory is relatively permanent storage form of learned information. Even though learning and memory are closely related, they are the two distinct phenomena. Memory helps us to remember the things, which we have learned. Learning is closely related with the usage of brain hemisphere and its dominant usage. The usage of dominant brain hemisphere, whether right or left side determine the academic results. Learning style of an individual is depends upon his or her dominant brain hemisphere usage. Boyle Dunn (1988) conducted a study on relationship between learning style and brain hemisphericity and the study revealed that brain hemisphericity greatly influences the individuals learning style and all kinds of intellectual and personnel characteristics.

Learning style can be classified into three major types such as visual, auditory and kinaesthetic. The learning style adopted and used by an individual from the above three categories of learning styles and s/he may learn using one of the learning styles. Some may use even two or three combinations of learning styles in their learning processes. Visual learners are the one who learn by visualising the things in their mind. They can see an image frequently in three dimensions, maps, drawings, timelines, graphs and symbols are the visual images they use as their study materials. These are the people who throw away directions and do it themselves

(Michelle Morris, learning styles of the left and right hemispheres). Auditory learners are the one who learn better through hearing. They will easily catch up and remember the things, which they have heard. Speeches, seminars and lectures are more useful for them than visual aids. They should include tape and tape recordings in their study materials. They are the one who retain the things better when they hear it frequently than they see it. Combined study will be a useful mode of learning for them.

The kinaesthetic learners use involvements of body in the learning process. They learn things better by doing it, rather than reading or hearing. Laboratory work and experiments are the main ways through which they learn. Experiential learning is the part of kinaesthetic learning. Whatever be the learning style we adopt its processing of the learned thing has to take place in the brain and the output of these things are the results which we obtain during examinations.

Brain hemisphericity is the tendency of an individual to process information through the left hemisphere or the right hemisphere or in combination (Bradshaw & Nettleton, 1981; McCarthy, 1996; Springer & Deutsch, 1993). Research has demonstrated that the left hemisphere operates in a linear, sequential manner with logical, analytical, propositional thought. On the other hand, the right hemisphere operates in a non-linear, simultaneous fashion and deal with nonverbal information as well as dreams and fantasy (Laccino, 1993; McCarthy, 1996, Oxford, 1996; Oxford, Ehrman, & Lavine, 1991; Springer & Deutsch, 1993; Torrance 1988).

The left hemisphere appears to be specialised for language whereas the right hemisphere is specialised for visuo-spatial and appositional thought. Kinsella (1995), Oxford (1996), and Oxford Ehrman and Lavine (1991) maintained that left hemisphere dominants are highly analytic, verbal, linear and logical learners. Whereas right hemispheric dominants are highly global, visual, relational and intuitive learners. Whole brain dominants are those who process information through both hemispheres equally and exhibit characteristics of both hemispheres. Those individuals have flexible use of both hemispheres (McCarthy, 1996).

Brain has got two cerebral hemispheres, each of which controls the contra lateral side of the body. Different functions are located in different areas of cerebral hemisphere. The flow of information is from periphery to thalamus to primary sensory area to successively higher order areas of cerebral cortex.

Majority of the people in the world are left brained people. The characteristics of the left brained people are logical, sequential, linear, analytical, reality based, objective, verbal and symbolic. Left brained people are probably punctual and can easily recall people's names. Prefer more formal and structured studies and like to learn in bright lighting. But the right brained people are intuitive, Random, Global, Fantasy based, creative, imaginative, subjective and nonverbal. Right brained people are impulsive. They can recall people's faces rather than their names. They also tend to be less punctual. Some people are using both the hemisphere for learning and they are considered to be whole brained, because they have many of the above qualities of both left and right brain.

Learning style and the dominance of brain hemisphere has related each other. Even the study subject selected by a person depends on which hemisphere is dominant in that person. The subjects selected for the study by each person is depends upon the type of dominant brain hemisphere. Arts/literature students tend to be right brained and commerce and business students are left brained (College students journal, June 2001 by Amany Saleh). Also many of the visual learners are found to be right brained. They need an environment rich in direct contact with the learning materials. Among these people, creative projects, visual exercise and exploring patterns would be the best study materials.

Learning style which one adopt greatly determines one's performance in the examination. Visual learners learn with the help of diagrams and pictures hence they can get good marks in the exam by answering with the help of pictures, diagrams and tables, but they may not perform well in the seminars and symposiums, which can affect their internal examination marks.

Auditory learners are good in learning the things that they hear and read. They rely less on pictures and diagrams. Even though they can reproduce the things in the examination, they cannot illustrate with the help of diagrams and pictures, which can badly influence their examination result. But auditory learners can perform well in the seminars and symposiums. Kinaesthetic learners can perform well for the practical examination, they than the theory exams. They can do better during lab works and experiments. Orlando Mata (2008) conducted a study to find out whether there is any kind of difference in learners' response on the ground of learning style. Study was conducted among English adult learners and he found out that there is difference in learner's response on the basis of learning.

Learning style modality of three learning styles are given below. The visual learners can write things down or drawing pictures, they can easily remember things with the help of Graphs and pictures. They used to put information in visual forms. They are often found to be well organised and they can watch rather than talk or act and can remember what they see. They like reading and a good speller. They often quiet in nature and used to notice details. But they are finding difficulty in concentrating during verbal activities. Auditory learners have the peculiarities like they can remember what they hear and say., talk aloud to themselves, enjoy listening to others reading aloud and used to whisper whilst reading. They like class discussions and need to talk through new learning. They will hum/sing as a part of their learning process. But they are not always good with written directions and they will be easily distracted with noise. Kinesthetic learners can remember what they do and experience. They like physical rewards; they used to touch people when talking to them. Usually, they work through problems physically with the help of pencil/foot, they find ways to move around and often loose interests when not actively involved. They are outgoing in nature and they cannot sit still for long. Usually they are poor speller.

To be flexible to meet any academic situation, all students need to use their strengths but also try to build up heir weaknesses. Those who learn to adapt study skills to incorporate all three learning styles, they can learn faster and remember longer. Neuro scientists noted that in the teaching and learning process right brain dominant people are preferred visual, special and analogical processing and the left-brain dominant people are preferred visual, logical, linear and sequential processing.

Dominance of the brain hemisphere also plays an important role in determining one's academic results. A work done by a psychologist namely Sperry on Brain hemisphericity led to the idea of people being left brain or right brain oriented. The left brain is generally associated with processing: names, spoken or written directions, especially if they are numbered sequentially; whereas the right brain generally is associated with processing: faces, directions that are demonstrated or illustrated, multi-tasking-meaning that the person likes to do several things at once and spatial ability.

Left brained people are more sequential so they will be able to answer in a more orderly way, also they are more analytical, so thy have got better reasoning ability so they can do well in descriptive examinations. Left brained people have little trouble in expressing themselves in words, so they can perform well in exam viva. But left brained ones are not imaginative and cannot think of new ideas and innovative things, so traditional schooling tends to favour left brained people.

Right brained persons rather than academic matters, they perform well in extracurricular activities. Most of the dancers, singers and stage players will be right brained people. Rather than bookish knowledge and information, they have their own way of dealing with things and they look at things in a different perspective. The world can know no bounds as far as their ability to create through fancy and imagination. Also, right brained persons well for lab exams. Laccino (1993) conducted a study on the working of right and left-brain hemisphere and he concluded that the left hemisphere operates in a linear, sequential manner with logical, analytical, proportional thought. Right hemisphere operates in a nonlinear, simultaneous fashion and deals with nonverbal information as well as dreams and fantasy.

Taking into all these considerations and without denying the fact that rather than learning style and brain hemisphericity there are many other factors, which can determine one's academic results. The study is aimed to determine the relationship between hemisphere usage and performance of learning style and how they

influence on the examination results. The subject for survey consists of 100 first year MBBS students from a government medical college, Kerala. The idea behind the study is to find the correlation between these two variables on an empirical basis and discussing the implications for an effective strategy construction. Roshan M Ali, University of Sains, Malsia (2006) conducted a study on the association between brain hemisphericity and learning style. This study was conducted among 44 students including males and females and the inference was: 71% of samples are left brain dominant, 24% are right brain dominant and the remains were whole brained learners. There is no association of brain hemisphericity with gender or programme of study. A study that investigated the correlation between student's choice of academic majors and their brain hemisphericity. The participants in this research were 429 graduates and under graduate students in a large university in the southern part of the United States. The data were analysed using analysis of variance to determine the influence of brain hemisphericity on student's choice of academic majors. The result lent support to earlier research in their findings of a strong correlation between academic majors and brain dominance. Arts/literature students tended to be right brained while business/commerce, engineering, and science were left brained. The study also demonstrated evidence of a general shift in students brain hemisphericity from earlier research, where more students were identified as whole brained.

Aim:

The aim of the study is to evaluate the effect of examination result based on the learning style and usage of brain (Dominant hemisphere left/Right/whole).

Objectives:

1. To identify the dominant hemisphere usage of the medical students.
2. To identify different styles of learning style among the medical students.
3. To evaluate the effect of learning style and brain usage on examination result of the students.

Hypothesis

1. There is a significant relationship between the learning style and the brain hemisphericity.
2. There is a significant difference between the examination results and learning style of the students.
3. There is a significant relationship between the examination result and the usage of brain hemisphere.

METHODOLOGY

Research Design selected for the study is descriptive design. Descriptive design is selected for this particular study since it is describing the different types of learning style in medicos and the dominant hemisphere usage and its effect on examination result: Both primary and secondary information collected for the study. Primary information collected from the students through questionnaire consists of standardised scales (Learning style Inventory and Test for identification of brain usage). And the secondary information collected do the first-year medical students obtain marks.

Research Data collection tools selected for the study is Scale and questionnaire.

Scale (1). Learning style test (BOSCH Learning style Inventory Scoring Procedure).

Scale (2). Test for identification of left and right brain usage (from right brained children in a left brained world by Jeffery Freed, Mat).

Population: Medical students are considered as the Universe of the study.

Sampling technique: Simple random sampling technique was selected as the sampling technique for the study.

Sample Size: 100 medical students consists of 1st year, 2nd year to 3rd year were selected for the study.

Statistical Technique used: Mean, Standard Deviation, test, Anova test, and correlation tests

Observations

In this study Learning style of the students were analysed and it is identified that out of 100 MBBS students, more than half (52%) of the students belongs to visual learners, 29% of them are auditory learners, 2% of them are kinaesthetic learners. Whereas 14% of them included in the category of both auditory and visual learners' category and 2% of them are included in the category of visual and kinaesthetic learning style and the remaining 1% included in the category of Auditory and kinaesthetic learning style.

Then each learning style was again categorised by combining it along with the brain hemisphericity. The inferences obtained are; Out of the 52 % students with visual learning style, 57.6% are whole brained. 21.1% students are with left brained and the remaining 21.1% of students are with right brain hemisphericity. Out of the 29% students with auditory learning style, 24.1% of them are left hemisphere dominance. 10.3% of the students have right brain hemisphere dominance and 65.55 of the students are found as whole brained. Out of 2% of students those who have kinaesthetic learning style. 50% of the students with kinaesthetic learning style are left brained and 50% of them are whole brained. Out of 14% students those who have visual and auditory learning style are whole brained, 21.4% are left brained, 7.1% are right brained. Out of 2% students those who have both visual and kinaesthetic learning style are whole brained and 50% are left brained. Out of 1% of students using both auditory and kinaesthetic learning style mainly have right brain hemisphericity. Among 100 students, only 2 students belong to the category 1 (Marks between 41-50) and among 1 was visual learner and other was auditory learners. 27 students were coming under the category 2 (Marks between 51-60) and among them 37% were auditory learners. 33% of them are visual learners 19% of them are visual and auditory learners and an equal percentage (4%) were of kinaesthetic and about 2% were visual and kinaesthetic learners. About 16 students belongs to category 4 (Marks between 71-80) and out of them 50% were visual learners 25% were auditory learners, 12.5% were auditory and visual learners and rest 6% were auditory and kinaesthetic learners. None of the students belongs to the category of 5 (marks 81-90).

On an analysis of practical examination results the findings were as follows:

There were no students belonging to category 1 (marks 41-50). About 6 students belongs to category 2 (marks 51-60) among them 50% were visual 33% auditory and 17% visual and auditory learners. 43 students were under category 3 (marks 61-70) among them 53% were visual learners 26% auditory, 14% both visual and auditory, 5% visual and kinaesthetic learners 26% auditory, 14% both visual and auditory, 5% visual and kinaesthetic learners and the rest 2% were kinaesthetic learners. Majority of the students were comes under the category of 4 (marks 71-80). Among the 45 students, 47% were visual 36% were auditory 16% both visual and auditory and 2% kinaesthetic learners. Among the category 5 (marks between 81-90), out of the 6 students 67% were visual, 17% were auditory and 17% were kinaesthetic and auditory learners.

To identify the learning style and brain hemisphere used by the students in category 4 that is who are scoring marks between 71-80, learning style and brain hemisphere used was tabulated and it was found that 31% of the students were visual and whole brained. 25% were auditory and whole brained, visual left brained, visual right brained, visual and auditory whole brained constitutes 12.5% each and 6% were auditory and kinaesthetic right brained.

In the practical examination, 45 students were comes under the category of 4 (marks 71-80) and out of these 23% each were visual whole brained and auditory whole brained, 14% each were visual right brained, 9% were auditory left brained and 2% each were auditory right brained, kinaesthetic left brained and visual and auditory right brained.

Among the 6 students belongs to category 5 scoring marks between 81-90 in practical examination 50% of them were visual whole brained and 17% each were visual left, auditory and kinaesthetic left brained and visual and auditory right brained.

Among the 6 students belongs to the category 5 scoring marks between 81-90 in the practical examination 50% of them were visual whole brained and 17% each were visual left, auditory and kinaesthetic right brained and auditory whole brained.

In this study it was observed that the learning style adopted by majority of the students who scored high marks for examination are visual learners and are whole brained.

One Sample t”test

Learning style Vs. Type of Brain Hemisphericity

Variables	Mean	Standard Deviation	“t” value =0.01 level.		
Learning Style	1.9100	1.21518	t	dt	Sig (2 tailed)
			15.718	99	0.000
Brain Hemisphericity	2.3800	0.83823	28.393	99	0.000

One sample “t” test was done among the variables learning styles and brain hemisphericity and the result of the test shows that there is a significant relationship between the learning style and the type of brain hemisphere used. So the hypothesis is accepted. There is a significant relationship between the learning style and the brain hemisphericity.

Table No.2

ONE SAMPLE ”t” TEST

LEARNING STYLE Vs. Theory examination result & practical examination results

Variables	Mean	SD	Test value (t value)		
Learning style	1.9100	1.21518	t	dt	Sig (2 tailed)
			15.718	99	0.000
Theory Examination	2.8500	0.70173	40.614	99	0.000
Practical exam result	3.500	0.70353	49.749	99	0.000

On an analysis on learning style and the result of the examination (theory and practical) , one sample test was done between variables001(learning style) and 003 (theory examination results) and 004 (practical examination results) and the study result shows that there is a significant difference between learning style and the result of the examination. This shows that which exists a definite relationship between learning style adopted and examination results obtained. So the hypothesis accepted. There is a significant difference between the examination result and learning style of the students.

ONE SAMPLE “T” TEST

THEORY EXAMINATION RESULTS & PRACTICAL EXAMINATION RESULT VS. BRAIN HEMISPHERE DOMINANCE.

	Mean	SD	“t” Value		
Theory exam result	2.8500	0.70173	t	Dt	Sig(2 tailed)
			40.614	99	0.000
Practical exam result	3.5000	0.70353	49.749	99	0.000
Brain Hemisphericity	2.3800	0.83823	28.393	99	0.000

One sample test was done between the variables 03(theory examination results), 004(practical examination results) and 002(brain hemisphere dominant).

Result obtained and there is a significant difference between theory and practical examination and the brain hemisphere dominance. This shows that the value obtained is significant and there exists a definite relationship between the brain hemisphere used and the theory, practical exam results. So the hypothesis “**There is significant relationship between the examination result and the usage of brain hemisphere.**” is accepted.

Correlation Test

variables	N	Mean	SD	p-value	Sig
Learning style & Brain Hemisphericity	100	1.9100 2.3800	1.21518 0.83823	.877	Perfect positive correlation
Learning style & Theory Examination Marks	100	1.9100 2.8500	1.21518 0.70173	0.224	Very low positive correlation
Learning style & Practical examination marks	100	1.9100 2.8500	1.21518 0.70353	0.770	Positive correlation
Brain Hemisphericity & Theory examination Marks	100	2.3800 2.8500	0.83823 0.70173	0.826	Perfect Correlation
Brain Hemisphericity & Practical Examination Marks.	100	2.3800 3.5000	0.83823 0.70353	.498	Perfect Moderate Correlation

Learning Style , Brain Hemisphericity Vs. Theory Examination Results, Practical examination results Correlation is significant at 0.01 levels. This shows that there is a definite relationship between the learning style adopted brains hemispheres used, theory ad practical examination results. Here the result of the study shows that there is a perfect positive correlation (.877) between learning style and brain hemisphere usage. Correlation test was applied to identify the relationship between learning style and theory examination. The result of the test reveals that there is a very low (.224) positive correlation between learning style and theory examination. The relationship between learning style and practical examination result was analysed through correlation test and it shows that there is a positive moderate correlation (.770) between these two variables. In the same way Brian hemisphericity and theory examination result was analysed and it is found that there is a perfect positive correlation (.826) between these variables. Also brain hemisphericity and its effects on

practical examination (.498) between these variables. So the result of the study shows that there is a relationship between students learning style, brain hemisphericity and the examination results.

Result obtained in the research were in accordance with our hypothesis that , There is a significant relationship between learning style and the usage of brain hemisphere.

There is a significant relationship between learning style and examination results.

There is a significant relationship between usage of brain hemisphere and the examination result.

We arrived at the above result with application of different statistical techniques namely one sample test, correlation test etc. and the result were failing in the significant range.

In our research, the learning styles used by more than half of the students were visual and majority of them were whole brained. Also visual learners who were whole brained scored highest marks both in theory as well as practical examination. Research studies are conducted earlier and the result of the study also shows that brain hemisphericity greatly influences the individual learning style and all kinds of intellectual and personal characteristics (Boyle and Dunn 1998, mc Carty 1996, shiflett 1989, Torrance 1982).

Thus we came to the conclusion that even though there may be many factors which determines one's academic result, learning style & brain hemisphericity plays an important role in determining one's performance in the examination.

So each student should understand one's own learning style and the need to use their strengths and also try to build up their weakness. A student who can incorporate all these three learning style will be able to learn faster and remember longer.

Also one should know his/her dominant brain hemisphere and should adopt the learning style, which can be better processed in the dominant hemisphere.

In the research finding , Majority of the students adopt visual learning style and most of them are whole brained.

If each student understands one's own learning style and if they can learn accordingly, they will be able to perform better in the examinations.

Suggestions for the visual learners are:

They should learn things by imaging the picture in three dimensions in their mind. They should use maps, etc. as their study tools, so that it can be better memorised. For the first year

Medicos, cadaver is the most important and useful study material for them. They can visualise all the structures in the human body and learn better. For studying functions of human body, working models will be really useful than learning by reading. For studying surgery, they should watch more number of surgeries and operative procedures, since they will be better useful for them than reading books.

Auditory learners learn better by reading things, they should sit in front of the class to hear lectures well. Lectures are very much useful to them. They can use tapes and recordings as their study tools. Seminars will be very useful to them. They should be encouraged to take seminars, so that they themselves can learn better. And also to teach others in a better way. For memorising the things better, they should repeat answers frequently; combined study will be very useful method of learning for them.

Kinaesthetic learners need to involve their body in the process of learning. Facts that must be learned should be written several times, keep a supply of scratch paper for the purpose. Taking and keeping notes will be very important. Take a walk and study your notes at the same time. From the research, the finding is that majority

of the students are visual learners. So our curriculum should be modified in such a way that t visual learners are benefitted better.

Our way of teaching should consist of video presentation so that with right brained learners (who are more imaginative and creative), left brained learners also get benefitted. By the video presentations they get to know more about the three dimensional pictures of what they are learning. With this it becomes easy for all kinds of students to excel in their studies.

The students should be encouraged more in studies with the help of diagrams; flow charts etc. while conducting these video presentations they should simultaneously explain it to the students. So that the auditory learners who are more particular in grasping things by hearing also get benefitted. Joyce & Hudson (1968) found when the learning style of medical students matched the teaching style of his or her instructor better examination results were achieved. How ever there has been little evidence else where to support this view that compatible learning and teaching styles enhance learning.

We can implement newer technologies in the curriculam like recording the lectures and smposiums and provide it to the students who can learn and recall better through this way.

A study conducted by Barkman (1991) revealed that the method of studying and the percentage of recalled the learning things. Reading helps to call the learned things only 10 percentage. Hearing can recall 20%, seeing and hearing 50%, student talking 70% and student talking and doing 90% of recalling capacity. Another study by Barkman (1991) showed that the method of instruction and the recalling rate of learned things. If the method of instruction is telling students will be able to recall 70% after 3 hours and they will be able to recall 10% after 3 days. If the method of instruction is showing students will be able to recall 72% after 3 hours and 20% will be recall after three days. And the method of instruction is showing and telling the students will be able to recall 85% and after three days they will have the capacity to recall 65% of the learned things.

Kinaesthetic learners should be encouraged to perform experiments and make models concerned with their studies. The American Psychological association (1992) recommended:

Students should be responsible for their own learning

Interaction between peers and teachers

Auditory, visual and kinaesthetic presentation

Learning strategies should be varied (eg. Problem solving, debate, discussions)

Everyone should understand one's own learning style and along with using their strength should try to build u their weaknesses and incorporate all the three learning styles., so that studying becomes more effective and better.

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