The Brain Dominance Theory and Its Implications on Science Education for Global Practices

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Abstract

The brain dominance theory states that the brain is made up of two parts, the right and left hemisphere. The two parts function differently and control different type of thinking. Individuals are said to be right brain or left brain dominance depending on the part that is dominant. This theory suggests that theway students learn and assimilate knowledge is related to the dominance of either the left or right hemisphere of their brain. Hence understanding the pattern of brain dominance could influence the learning and teaching styles adopted by science teachers. This paper discusses the brain dominance theory and considers its relevance to science teaching, implications of brain dominance theory for science education are outlined and conclusions are discussed. It recommends that science teachers should not rely on traditional method of teaching, rather innovative methods which challenge the right and left brain should be adopted in the teaching of science.

Keywords: Brain, Brain dominance, Science education**.**

Introduction

Science is a body of organized knowledge obtain through observation and experimentation. The Science Council (2023) defines Science as the pursuit and application of knowledge and understanding of the natural and social world following a systematic methodology based on evidence. Science is made up of two parts namely, process and product. Science as a process deals with the method of scientific investigation, the attitude of mind that guides scientific investigation like honesty, open-mindedness, objectivity, ingenuity and others. The products of science yield scientific hypotheses, theories, principles and laws.

Science is guided by natural laws; it is testable though tentative. According to Modal (2019), Science is objective, systematic, tentative, precise, ethically neutral, verifiable, systematic, reliable, accurate, abstract and predictable. Science provides knowledge and technology provides ways of using this knowledge. Technology is the application of scientific discoveries for practical purposes in order to solve problems or invent tools. Lane (2020) argued that technology is taking action to meet a human need rather than merely understanding the working of the natural world. Development and advancement in technology depends on science, this implies that without science, there is no technology. Technology brings about political and economic change and makes one to remain current with civilization, modern life is also achieved through technology.

Countries of the world are divided into two major categories by the United Nations namely develop countries and developing countries (Surbhi, 2020). The classification is based on economic status, industrialization, the standard of life among others. Surbhi (2020) defined developed countries as sovereign state whose economy has highly progressed and possesses great technological infrastructure and developing countries as countries with low industrialization and low human development index. Also, developed countries are peaceful, educated and healthy whereas these things are lacking in developing countries. According to Olalekan and Omosewo (2018) developed countries of the world share similar characteristics in technological advancement while developing countries share limitation in scientific and technological knowledge. Nigeria is a developing country, for her to be able to compete technologically with the rest of the world and to attained the level of a developed country, she must develop

scientifically and technologically; The only way of doing this is to strengthen Science education which is the gateway for self-reliance and self –sufficiency.

Science Education is a field concerned with the production of scientifically literate citizens. Nwanekezie and Arokoyu (2020) defined Science education as the study of the interrelationships between science as a discipline and the application of educational principles to its understanding, teaching and learning. It is concerned with the search for relevant contents and new methods of science teaching and learning. Science education is absolutely necessary for national development because the development of any society is assessed by its science and technological advancement and the level of scientific literacy of its citizens. According to the National Policy on Education by the Federal Republic of Nigeria (FRN, 2021), the goals of Science Education in Nigeria are to: Cultivate inquiry, knowing and rational mind for the conduct of a good life and democracy, produce scientist for national development, service studies in technology and the cause of technological development, produce knowledge of the physical world, the forms and the conduct of life.

Despite the importance of science education to national development and the role it plays in socio economic advancement, Nigeria has not been able to achieve the goal of science education. Science education in Nigeria is not adequate enough to produce skilled human resources needed for transformation into national prosperity (Olalekan and Omosewo, 2018). This is obvious from the poor state of scientific and technological development and the level of unemployment in the country. This type of science education cannot empower the learner to bring about sustainable development to the citizens. Our science education only equips the learner on how to used technological gadgets than on the knowledge of how they are made or maintained, this has contributed to the state of underdevelopment. The only way science education can be strengthened is through improvement in its teaching and learning.

Edem and Akpan (2020) in an attempt to survey the current challenges in science education in Nigeria reported the following findings: Government do not often train and retrain science teachers, most teachers in primary and secondary schools are not qualified to teach science, poor funding, insufficient quantities of modern reading and learning aids, use of irrelevant and obsolete curriculum and poor methods of teaching science in schools. This calls for an urgent need for a total overhauling or restructuring of science education in primary and secondary schools in Nigeria. One way of teaching science effectively is to consider how the brain works. Human brain is essential in learning because the brain is where information is processed and it works in accordance with the specialization of its structure and functions (Li, Hanafish, Rezai and Ilumar, 2022).

The Brain

The brain is an organ that is made of a large mass of nerve tissues. It is found in the anterior end of an organism and is protected within the skull. It controls one's ability to think, see, hear, walk, feel and remember things. It is the seat of intelligence as well as the centre of learning. The brain is divided into two halves called right and left hemisphere (brain). The two- halves are separated by a band of tissue called corpus callosum. The two halves also communicate with each other through the corpus callosum. The left hemisphere controls the right side of the body while the right hemisphere controls the left side of the body.

The brain dominance theory originated from the work of Roger W. Sperry, who was awarded the noble price in 1981 (Pietrangle, 2022). The theory holds that people are either left – brained or right – brained, meaning that one side of the brain is dominant. This theory is based on lateralization of brain function; this means that the brain contains two hemispheres and the two hemispheres function differently. According to the Brain dominance theory, the right side of the brain is best at expressive and creative tasks. There are several abilities popularly

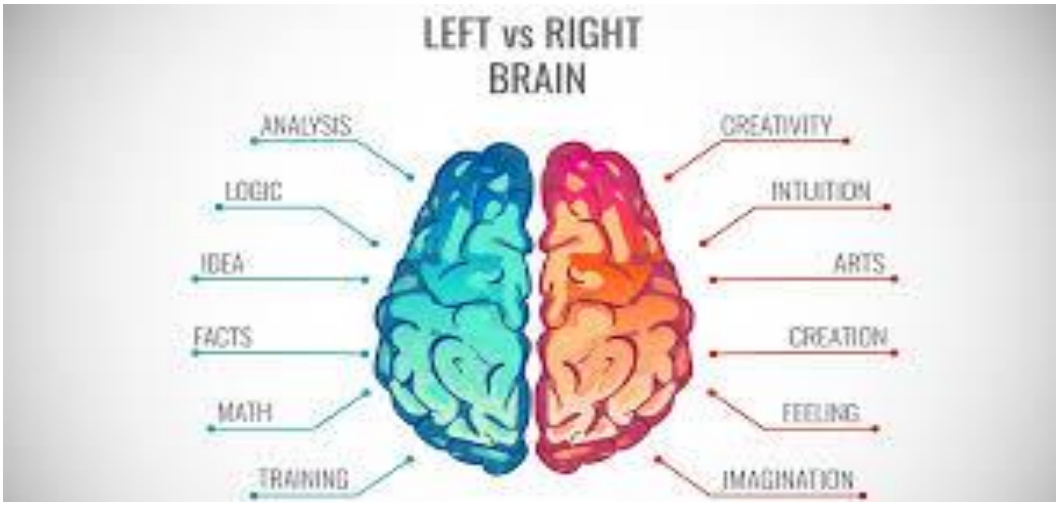
associated with the right side of the brain. Based on these, a right – brained thinker is good at recognizing faces, expressing emotions, creating music, reading emotions, holistic thinking, appreciating colours, using imagination, being intuitive and creative. They are often described as doing well in careers that involve creative expression and free thinking such as becoming an artist, psychologist or writer. The left side of the brain is adept at certain tasks; Characteristics of the left brain include those related to language, logic, critical thinking, numbers and reasoning. The left brained people are described as logical, analytical and orderly. The theory suggests that people who are left –brain dominant do well in careers that involve linear thinking, Mathematics and verbal information. These include careers such as accountant, scientist or computer programme.

According to the theory of left brain or right brain dominance, each side of the brain controls different type of thinking (Kendra, 2022). Additionally, people are said to prefer one type of thinking over the other. For example, a person who is "left brained" is said to be more logical, analytical and objective. A person who is "right-brained" is said to be more intuitive, thoughtful and subjective. The left and right brain dominance theory is based on the lateralization of brain functions. According to Guy-Evans (2021) lateralization of brain function is the view that functions are performed by distinct regions of the brain, this implies that if a certain area of the brain becomes damaged, the function associated with that area will also be affected. It states that each hemisphere of the brain controls different types of thinking and activity and that every individual has a preferred type of thinking over the other (Nwanekezie & Orokoyu, 2020).

Carthey (2019) stated that left-brained individuals solved problems by breaking down problems into their component parts, when left brain individuals read, they read in detail and analyze carefully all the information received. They may have problem in recognizing the faces of people but are good at remembering names of people. Oflax (2015) reported that left brain individuals make lists and schedules, they always want to know the rules and follow them, they have little problems expressing themselves in words and are precise in choosing words, they are also good at processing symbols and mathematical formulae. A study carried out by Benedict and Coffield (2019) showed that students who are left brained score significantly higher in multiple choice questions than the right brained students, also left brained students are auditory learners; this implies that they prefer lecture teaching method

On the other hand, right brained individuals use mostly their feelings about something to decide if it is true or not, they are holistic learners, they need to see the whole picture then examine and learn about all the parts that create the whole. They are creative and imaginative. Singing, music, art, writing, designing, painting and anything that require creativity is easy for right brained individuals. They have problem finding the right word to express themselves. They are visual learners who can see a three dimensional image in their minds. They like things to be concrete so they like to see, feel or touch the real object (Oflax, 2016). Saleh (2021) mentioned that people choose their academic majors on the compatibility between the norms of these academic fields and the individuals' hemispheric dominance. Hence academic subjects like arts, humanities and architecture are suitable for right brain dominant students, while subjects such as science, engineering and language which emphasize logic and verbal analysis are better fitted for left – brain dominant students. Individuals who are whole brained, process information and experiences on both hemispheres of their brain. Their mode of thinking allows them to use both hemispheres equally; hence they are highly conscientious, emotionally stable and flexible. They are not major risk taker but they are likely to make good decisions which help them perform better in all areas of life. The do have preferred pattern of thinking and this gives them certain priorities in the instructional process and environment on the part of both the learner and the teacher.

Diagram showing the left and right brain



Source: Don Lincoln (2020).

Saleh (2021) mentioned that having knowledge of the brain dominance characteristics of learners in the classroom will place them in a situation where they are more likely to succeed. It will also give the teachers insight into what types of students are being taught by indicating how they process information. It also informs them about the reasons why they prefer certain activities or have certain interest. Also, when students understand their strength and weakness in certain areas, they are able to develop better ways to learn and study. Morris (2016) reported that traditional schooling tends to favour left brained people. The students are usually taught by left brained teachers who love order, sequence and planning. Right brain learners are not rewarded for using different ways to process information and right brain thinking is the essence of creativity.

Revell (2020) stated that we all live in a society which tends to respect and nurture the left brain more than the right. The educational system often teaches students that remembering facts is more important than being creative and imaginative. Their right brain are not considered in the learning process while their left brain are promoted. This has resulted in the production of science graduates who can memorise and regurgitate fact but cannot solved scientific problem that requires creativity and application of knowledge. Revell (2020) concluded that the brain should be maximized as a whole by teachers through balancing learner- centred and teacher- centred activities.

Many teachers have difficulties with some children, such as keeping them still and focused, finishing assignment, keeping organized and grasping concept the way they are taught. Lim *et al*. (2020) mentioned that the reasons are specifically related with the dominant side of the brain. On that note, educators should make effort to understand the ideal ways students learn and fine-tune their lessons to the diverse needs of their students. Teachers should make effort to include varieties of teaching styles and learning activities that promotes imagination and spatial skills which are associated with right brain characteristics. Also, right brained students are very concrete, that requires providing them with visual aids like pictures or videos for a better understanding of the lesson otherwise

they will not understand the lesson. Also, students understanding of their strength and weakness in certain area can help them develop better ways to learn and study.

Implication on Science Education for Global Practice

There is strong evidence that there are individual differences among learners, to the extent that one side of the brain is more utilised than the other, These findings suggest that for our students' to be able to compete globally, individual learning styles should be recognized and necessary adjustments be made so that the subject matter may be taught through methods that accommodate the varying learning styles of students in the classroom. The implications on science education are:

1. Science teachers should make concerted effort to revamp the measurement of student intellectual abilities. Examination questions in our schools rely almost exclusively on the measurement of left brain function, the tendency is to give more emphasis to the memorization of verbal facts, this has ignored the correlation of intelligence scores with the solving of insight problem through application of knowledge, which is a function of the right brain hemisphere
2. Activities in science classroom should be aimed at both side of the brain with particular attention given to right brain activities to compensate for traditional left brain teaching strategy, science teachers should include many visual activities including the use of interactive smart board, chalkboard, diagrams, pictures, videos, charts, artefacts, maps and realia.
3. Students' poor performance in external examination in science subject can be averted with proper implementation of the curriculum. Teaching activities should be based on the strength of both sides of the brain, for instance learning activities could be introduced visually and then translated to language to accommodate left and right brain learners. This could be done through the use of charts, graphs, models, field trips, guest speakers and others. This enables students to see how concepts fit into the real world.
4. Piaget's theory of cognitive development should be considered by science teachers especially in the teaching of Basic science and technology, hands- on activities should be provided during the concrete operational years of learning in elementary and junior secondary school. Also, the level of brain development may affect comprehension and readiness for a particular task, so teachers should provide brain compatible instruction.
5. Talking enhances learning for both the left and right brain preference learners and is particularly important for the right brain learners, science teachers should incorporate discussion teaching strategy in the teaching of science and all the students should be involved, it may be in the form of presentation. This will improve the communication skills of the learners.
6. Science teachers should incorporate the use of colours in the teaching strategies used. Concepts can be more readily communicated by use of colours. For instance, in a Biology class, different parts of diagram could be highlighted using different colours, this will enhanced comprehension and retention.
7. Science teachers should incorporate all the five senses in the teaching of science, by doing this, concepts can be more readily grasped and recall is enhanced. For instance, when teaching fruits in a Biology class, make fruits available, have the students touch it and describe its texture, have them smell and describe its odour, have them taste it and describe its flavour, this will activate their senses and enhanced comprehension and retention.
8. Drawing is important in a science classroom, this will enhance the understanding of a concept and it is particularly good for left brain students. Drawing enables, the brain to make connections that enhances better retention. Aside from being a learning tool, drawing can also serve as an evaluation tool in a science classroom.

Conclusion

The way students learn and assimilate knowledge is related to the dominance of either the left or right hemisphere of their brain. Left brain dominant individuals are more analytical, logical and organized while the right brain dominant individuals are creative, artistic and imaginative. The traditional school system tends to favour the left brain individuals who are also taught by left brain teachers. Rote learning which involves memorization and recalling of facts is emphasized while creativity is impaired. It ought not to be so, this has resulted in the production of science graduates who can memorize and regurgitate scientific facts but cannot solve societal problems that require application of scientific knowledge. The right brain individuals are suffocated in the classroom because the school system does not favour the assimilation of knowledge in a different way. These individuals are creative, imaginative and intuitive and can think outside the box, they are musicians, painters and writers but unfortunately some of them end up dropping out of school. Learners tend to reach higher levels of performance when they are taught the ways that are compatible with their right or left mode preferences. Teachers should therefore learn to understand the ideal ways students learn and deliver their lessons according to the diverse needs of their students.

Recommendations

The following recommendations are made:

1. Science teachers must make efforts to develop the total brain in learners at early stage of development because the way the young brain is used influences its later development.
2. Science teachers should not rely on traditional method of teaching, rather innovative methods which challenge the right brain should be adopted in the teaching of science
3. Science teachers should translate research findings into practice as soon as possible
4. Curriculum planners should incorporate activities that promote creativity into the curriculum.
5. Government should train and retrain science teachers on the use of innovative strategies that will promote both right and left brain thinkers.

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