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APPLICATION AND CONSTRAINTS OF BRAIN-BASED LEARNING IN PHYSICS EDUCATION

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Abstract

Purpose: This paper examines the application of brain-based learning in the teaching of Physics in the selected colleges of education in Oyo State. This study also seeks to identify the constraints and measure the perceptions of both students and teachers in the utilization of brain-based learning models in the teaching of Physics in the selected colleges of education.

Methodology: This study adopted a quantitative research methodology in accomplishing the purpose and objectives identified. Multistage sampling was used in selecting a sample of 162 respondents (42 lecturers and 120 students). Instruments for data collection were Lecturers and Students Questionnaire Descriptive statistics (frequency and percentage counts) were used in analyzing the data.

Findings: The results revealed that lecturers adopt the use of brain-based techniques in the teaching of optics, mechanics, and thermodynamics. However, in the teaching of concepts like nuclear physics relativity, and quantum mechanics the adoption level was low. A majority of lecturers further stated that this technique is only effective in a small class size. The responses of the students also point to the fact that a larger majority of them prefer a brain-based learning environment to the current teacher-focused mode of learning.

Unique contribution to theory, practice and policy: It is recommended that educational training in Nigeria should focus not only on curriculum and students' management but also on models such as brain-based learning in its practical dimension.

Keywords: *Brain-based learning, Physics education*

Introduction

In recent years, one of the more important realizations in the teaching of Physics and science subjects generally is the inadequacy of the current pedagogies utilized as the basis for the teaching and learning process. According to Aina and Ayodele (2018), the current paradigm informing the transmission of scientific knowledge is curriculum-driven. As such teachers are more interested in finishing the curriculum rather than tailoring the process of knowledge acquisition and transmission to the normal developmental process of the human brain. A dominant thought in modern education, especially in developing countries is the forgetting that there is a very strong connection between brain processes and learning. Omorogbe and Ewansiha (2013) maintained that the various challenges facing science education include poor students' mode of learning, poor students' enrolment, and poor teachers' pedagogies that require new approaches. Brain-based learning has been touted as one of the models with demonstrated potential to solve the problems associated with science education in Nigeria.

According to Jensen (2008), brain-based learning can be conceptualized as learning aligned with how the human brain naturally learns. For Jack et al., (2018), brain-based learning is learning- an instructional model that is comprised of teacher-facilitated and learner-centered methods which employ the cognitive gifts of the learner. Brain-based learning is a collection of techniques stemming from research in cognitive science, psychology, and neurology and which are tailored towards enhancing the instructions given by a teacher by aligning such instructions with the workings of the brain. The evolution and emergence of brain-based learning can be traced to the last two decades of the twentieth century when advances in information technology allowed researchers to study brain processes using technologies such as Magnetic Resonance Imaging (MRI) and Positron Emission Tomography (PET).

Advances in technology provided solid evidence to the assertions that the brain is a parallel processing machine that seeks to make meaning through the process of patterning (Ozbay and Memis, 2015). Brain-based learning was therefore promoted as a model which can allow for learning to take place in an environment that recognizes the peculiarities of the brain and also enhance the cognitive structures of the learner. Jack and Kyado (2017) asserted that brain-based learning offers a mode of thinking about the learning process which is predicated on the cardinal principle that meaningful learning does not occur in a single way, but rather in the integration of emotions, enriched environments, making meaning and the absence of threats.

The application of brain-based learning as an alternative to other traditional pedagogies is premised on the underlying principles of brain-based learning which gives it an edge in the process of teaching and learning, According to Caine and Caine (1990), there are twelve principles underlying brain-based learning. The first six principles revolve around processing and patterning; the brain is a parallel processor, learning engages the entire physiology, the search for meaning is innate and occurs through patterning, emotions are critical to patterning and every human brain simultaneously perceives and creates parts and whole. The second set of principles revolves around attention, perception, memory, and threat. These principles are that: learning involves peripheral perception and focused attention, involves conscious and unconscious processes, utilizes spatial and rote memory systems, understands and remembers best when facts and skills are embedded in natural spatial memory, and is enhanced by challenges and inhibited by threats. The last principle is the uniqueness of every brain.

Proponents of brain-based learning (Akinbobola, 2015; Mekarina and Ningsih, 2017; Aina, 2018; Jack et al, 2018) have noted that the principles underlying brain-based learning serves as valuable input in the design of learning environments that integrate with other factors during the learning process. Such factors include emotions, nutrition, level of participation in the learning process, and the physical safety of the learning environment. These principles are also instrumental in accounting for individual differences, maximizing the natural learning processes of the brain, and diversifying teaching strategies (Mekarina and Ningsih, 2017). Salmiza (2011) had earlier noted that the underlying principles of brain-based learning are valuable inputs in the design of learning systems that have been demonstrated to improve learning, ensure the provision of equal opportunities for individual differences and increase the overall level of academic achievement. The achievement of these results is based on the instructional learning techniques which the brain-based model fosters. These are active processing, relaxed alertness, and orchestrated immersion (Jack et al, 2018).

The need to strengthen science education to meet the myriad of challenges has necessitated the development of such learning traits as the spirit of inquiry, creativity, objectivity, courage to question, and aesthetic sensitivity. Remadevi (2014) noted that brain-based learning help in instilling these values and thus indirectly helps solve learning problems giving positive hope to students provides an avenue for forging connections among and between new learning situations and prior ones. According to Caine and Caine (1990), brain-based learning helps in solving learning problems by serving as the medium of a paradigm shift from the brain-antagonistic pedagogies to one which emphasizes ample learning times, the absence of threats, dynamic interactions, global contexts, immediate feedback and the delineation of parts in a state of relaxed alertness. Duman (2005) recognized that one of the learning problems in modern education systems relates to sustaining the interests and attention of students. This is because the most prevalent pedagogies employed in teaching students do not stimulate mental challenges which are precursors to deep learning experiences. The brain-based model of learning helps in remedying this problem by providing techniques that immerse the learners in complex, interactive experiences that are both rich and real (Olaoluwa and Ayantoye, 2016).

1. The applicability of brain-based learning to Physics Education in Nigeria

The scientific study of motion and energy codified in Physics has an evolution that paralleled modern development. According to Omosewo (1999), Physics is an important discipline and a fundamental component of any significant national technological drive. Jegede et al., (2013) also noted that Physics remains one of the core science subjects taught at colleges of education which also serves as a platform for realizing the educational goals of critical thinking, analytical reasoning, and the spirit of inquiry. Jack et al (2018) expressed that Physics is a core science subject at the colleges of education in Nigeria because of its importance in national development. The importance of Physics to technology development has earned it a place as a core and innovative subject for science students that want to teach it as a profession in the future.

Despite the importance of Physics, a recurring trend is the increasingly low enrolment of students interested in Physics in the colleges of education and a decline in the number of Physics students who graduates from the colleges of education in Nigeria (Omosewo, 1999; Amuche and Iyekekpolor, 2016; Jack et al., 2018). This trend has been attributed to several underlying factors. These include the perception among students that Physics is an extremely difficult subject and the poor achievement levels of Physics students triggered by poor knowledge retention and attitudes Physics students. Jegede et al., (2015) asserted that this undesirable trend is a result of the difficulty of 'students' understanding the underlining concepts, due to the mere absence of an effective learning theory for imparting knowledge of Physics concepts.

The cardinal importance attached to Physics as a tool for national development coupled with the discovery of researchers that a focus on only the cognitive aspect of teaching and learning is inadequate in imparting knowledge is increasingly fuelling a shift from a teacher-centered approach to a student-centered approach (Jack et al, 2018). One such student-centered approach that is rapidly gaining acceptance is the brain-based learning model. Amuche and Iyekekpolor (2016) reported that the use of the brain-based learning model in Nigeria is still considered experimental and used only in some instances and depending on the discretion of the teacher/lecturer. Nevertheless, studies such as Saleh (2011); Jack and Kyado (2017) have reported that while the predominant teacher-centered approach can be used in teaching a large number of students, it is not as effective as the brain-based learning model in mastering the principles of the aspects of Physics such as mechanics, electromagnetism, optics and thermodynamics and advanced areas such as Relativity, Nuclear Physics, and Quantum Mechanics.

To strengthen the learning of Physics in the Nigerian colleges of education, the importance of brain-based learning cannot be over-emphasized. The techniques of the model have been demonstrated as instrumental in creating student success which is based on positive students' perceptions (Jack et al., 2018). This is achieved by instilling a sense of conceptual meaning and transition from the simple to the complex or the known to the unknown which helps in eradicating the negative perceptions and low expectancies of students.

Studying the application and constraints of brain-based learning in the context of Physics education is important for several reasons. First, the teaching of Physics in the colleges of education is an important mechanism in transmitting the knowledge of Physics to the primary and secondary levels of education in Nigeria. As such effectiveness in learning must be guaranteed at this stage if the negative trend in Physics education in Nigeria must be reversed. Secondly, while the superiority of brain-based learning has been demonstrated over conventional methods in terms of understanding, attitude, and knowledge retention, the widespread use of the model is constrained by factors that must be resolved if significant systemic gains from the use of the method in Physics education must be realized. Filling these gaps (application and constraints) thus defined the purpose of this study.

2. Purpose of the study

The purpose of the study is to examine the application of brain-based learning in the teaching of Physics in the selected colleges of education in Oyo State. This study also seeks to identify the constraints faced in the utilization of brain-based learning models in the teaching of Physics in the selected colleges of education. The study has the following specific objectives;

1. To determine the extent of application of the brain-based learning model in the teaching of Physics education.
2. To measure the perceptions of lecturers on the applicability of the brain-based learning model in the teaching of Physics in selected colleges of education.
3. To identify the constraints limiting the utilization of brain-based learning by lecturers of selected colleges of education in teaching Physics.
4. To measure the perceptions of students on the utilization of the brain-based learning model in the teaching of Physics education.

3. Research Questions

Based on the objectives identified in the previous section, this study was guided by the following research questions;

1. What is the extent of the application of brain-based learning in teaching identified modules of Physics?
2. What are the perceptions of lecturers on the applicability of the brain-based learning model in the teaching of identified modules of Physics?
3. What are the constraints limiting the utilization of brain-based learning by lecturers of selected colleges of education in teaching Physics?
4. What are the perceptions of students on the utilization brain-based learning model in the teaching of Physics education?

5. Materials and Methods

This study adopted a quantitative research methodology in accomplishing the purpose and objectives identified. The use of questionnaires provided a means through which the views of multiple residents can be aggregated and analyzed (Ghavifekr and Rosdy, 2015). The questions contained in the questionnaire were tailored toward measuring the extent of application of brain-based learning in teaching identified modules of Physics, the perceptions of lecturers on the applicability of the brain-based learning model, the constraints limiting the utilization of brain-based learning by lecturers, and the perceptions of students on the utilization brain-based learning model in the teaching of Physics education.

The population of the study included the respondents who provided answers to the research questions. The respondents for the study are the Physics lecturers and students. The Physics lecturers provided data that was used in resolving research questions 1, 2, and 3 while data for

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resolving research question 4 was elicited from the Physics students. In selecting the respondents, purposive sampling was used to select four colleges of education in Oyo State. The reason for their selection was that they offer Physics education as a distinct course on its own. The colleges of education selected are the Federal College of Education (FCE), Emmanuel Alayande College of Education (EACOED), The College of Education, Lanlate (COEL), and Muftau Lanihun College of Education (MLCE), all in Oyo state Nigeria.

Physics education lecturers from the population responded to the questionnaire designed for lecturers while a two-stage sampling procedure was used in selecting the students. Purposive sampling was used to select students in years 2 and 3 while simple random sampling was used in selecting 60 students from each year to give a total of 120 students. The choice of second- and third-year students was premised on their familiarity with the modules and use of brain-based learning models and as such can make comparisons with other models. The total number of lecturers polled was 42 (FCE- 11, EACOED, 16, COEL- 9, MLCE- 6). The total number of questionnaires distributed was 162 (42 lecturers, 120 students).

Two different questionnaires were designed for the research to provide information from the two target groups (lecturers and students). The questionnaires were distributed to the respondents physically after which collation and data analysis was done. Descriptive statistics (frequency and percentage counts) were used in analyzing the data while the mean score (MS) was used in computing the significance of answers that were responded to using the Likert scale. The questionnaire for teachers had 23 items and was divided into four sections. In the questionnaire, the extent of the application of the brain-based model was measured using a five-point Likert- scale while perceptions and constraints were measured using a four-point Likert scale. The questionnaire addressed to students had 16 items and constraints and perceptions were also measured using a four-point Likert scale. The frequencies of the items were checked and discussions were presented to explain the observations from the responses of the students and teachers assessing their means, standard deviations, frequency, and percentages.

6. Findings and Discussions of Findings

6.1: Lecturers' Responses

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Table 1: Mean responses on the extent of application of brain-based learning model in the teaching of Physics education

S/N	Items	N	Mean	Remark
1	Optics	42	3.9767	High
2	Mechanics	42	3.7654	High
3	Thermodynamics	42	3.7165	High
4	Quantum mechanics	42	1.7614	Low
5	Relativity	42	1.8798	Low
6	Nuclear physics	42	2.1987	Low

Table 1 shows the extent to which lecturers claim they used brain-based techniques. Optics had a mean score of 3.9767 while mechanics and thermodynamics had mean scores of 3.7654 and 3.7165 respectively. The implication of this is that lecturers use brain-based learning to a greater extent in these fields. This can be attributed to the existing practice that requires ascertaining the student's previous knowledge in every field and connecting with the present lesson for higher coherence which is one of the critical factors of the success of brain-based learning (Bonomo 2017). Quantum Mechanics, Relativity, and Nuclear Physics had an MS of 1.7614. 1.8798 and 2.1987 respectively indicating that the brain-based learning models are low. The low rate can be attributed to a lack of teaching skills with brain-based techniques. This assertion was confirmed by an earlier study carried out by Awolola (2011) who advised that there should be the training of teachers on the adoption of brain-based learning strategies in the state for better students' learning outcomes.

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Table 2: Percentage and frequency count on perception of lecturers on the applicability of brain-based learning model in the teaching of Physics

S/N	Items	N	Characteristics	%	Frequency
1	The brain-based learning model is only compatible with a small class size	42	Strongly Agree	62	26
			Agree	17	7
			Disagree	15	6
			Strongly Disagree	6	3
2	The design of the Physics curriculum does not support brain-based learning	42	Strongly Agree	43	18
			Agree	29	12
			Disagree	12	5
			Strongly Disagree	16	7
3	Brain-based learning can only be used for theoretical subjects and not practical ones.	42	Strongly Agree	7	3
			Agree	12	5
			Disagree	14.3	6
			Strongly Disagree	66.7	28
4	Brain-based learning is slower in transmitting knowledge to students	42	Strongly Agree	30	12
			Agree	19	8
			Disagree	33	14
			Strongly Disagree	18	8
5	Students should be allowed time to rest their brains and reinforce learning	42	Strongly Agree	20	8
			Agree	26	11

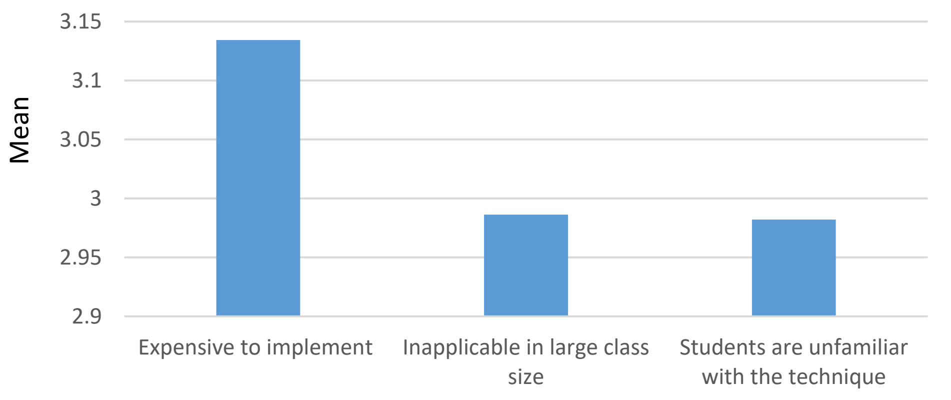
			Disagree	25.5	11
			Strongly Disagree	28.5	12
6	Brain-based learning is more effective for less intelligent students	42	Strongly Agree	24	10
			Agree	45	19
			Disagree	14	6
			Strongly Disagree	17	7
7	Lecture-based learning is more effective than brain-based learning	42	Strongly Agree	10	4
			Agree	18.5	8
			Disagree	28.5	12
			Strongly Disagree	43	18

Table 2 measured the perception of lecturers on the applicability of the brain-based learning model in the teaching of Physics in selected colleges of education. From the data collected, 62% of the lecturers strongly agreed that brain-based learning is only compatible with a small class size while the percentage that disagreed and strongly disagreed was 21%. This study reaffirms the submission of Serap and Melek (2009) who opined that higher learning retention and a positive attitude toward learning through brain-based techniques are positively influenced by the learning environment. Awolola (2011) advised that the cognitive style of the individual students and the instructional strategy adopted in each classroom situation positively impact the success of brain-based learning techniques in a subject like Physics. He noted that this will reduce the frustration of the students and the teachers and enhance the learning outcome. It can be stated that the 21% of the respondents that disagreed with the classroom condition may be responding to the study out of ignorance as a result of the initially identified low adoption of brain-based techniques in Oyo state.

The study further revealed that 43% and 29% respectively strongly agreed and agreed that the way the Physics curriculum is designed does not support brain-based learning while another 12% disagreed with the question. This corroborated with the study carried out by Politano (2000) in which he opined that; students learn more when the curriculum is designed to solve real challenges. Atakent and Akar (2003) further stated that when less but more complex projects are assigned to the students, it makes the brain to be challenged leading to its higher development, and higher ability to understand and retain complex concepts and practices. This can be achieved by designing a curriculum that supports the new learning technique.

34 out of the 42 lecturers disagreed (disagree and strongly disagree) that Brain-based learning can only be used for theoretical subjects and not practical ones. This substantiated Jayalakshmi and Annakodi (2013) assertion that provided that the brain is not hindered from carrying out its normal functions, learning will take place irrespective of whether it is theoretical or practical learning by engaging the two sides of the brain hemispheres for a stronger, meaningful and better learning experience. The data also showed that only 49% of the lecturers believe that brain-based learning is slower in transmitting knowledge to students. Though the finding can be argued by researchers, Jayalakshmi and Annakodi suggested that time should be set aside for students to rest their brains between lessons to reinforce students' focus on the learning task. 12 lecturers (28.5%) strongly disagreed with this point. The disagreement was in line with the research conducted by Sousa (2008) that revealed that even students with learning disabilities perform better when brain-based learning is applied with an effective strategy, just as more lecturers in the study responded that brain-based learning is more effective for less intelligent students (24% strongly agree, 45% agree). Also, out of the 42 lecturers polled, 12 disagreed with the statement that *lecture-based learning is more effective than brain-based learning,* while another 18 strongly disagreed.

Figure 1: Lecturers perceptions of constraints limiting the utilization of brain- based learning in teaching Physics



In Figure 1, the mean score used as the benchmark for significance is 2.5 (since the question was based on a four-point Likert scale). The perception that brain-based learning is expensive to implement is the most significant with a mean score of 3.1343 while the perception that brain-based learning can only be used in handling a small student population has a significance of 2.9863. 23% and 45% of lecturers respectively strongly agreed and agreed that the design of the Physics curriculum for Nigerian Colleges of Education does not support brain-based learning. Just as research has revealed that there is a missing link between the actual activities in the classroom and the way the curriculum is designed especially on a subject that calls for calculations such as Physics (Awofala 2002). Another significant constraint (MS= 2.9821) as asserted by the lecturers was that students are not familiar with brain-based learning techniques. This could be because of its low adoption in the schools studied.

6.2: Students' Responses

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Table 3: Percentage and frequency count on perceptions of students on the constraints limiting the utilization of brain-based learning in the teaching of Physics

S/N	Item Statement	N	Characteristics	%	Frequency
1	Brain-based learning model reduces the pace of learning	120	Strongly Agree	23	28
			Agree	24	29
			Disagree	26	31
			Strongly Disagree	27	32
2	I do not have the self-discipline to follow a self-paced program	120	Strongly Agree	27.5	33
			Agree	32	38
			Disagree	15.5	19
			Strongly Disagree	25	30
3	The huge volume of work to be handled does not allow for the use of a brain-based learning model	120	Strongly Agree	65	78
			Agree	15	18
			Disagree	11	13
			Strongly Disagree	9	11
4	Lecturers do not know to handle a class designed according to a brain-based model	120	Strongly Agree	61	73
			Agree	23	28
			Disagree	10	12
5			Strongly Disagree	6	7
6		120	Strongly Agree	23	28
			Agree	20	24

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Contact periods are too brief to allow for brain-based learning in the teaching of Physics	Disagree	35	42
	Strongly Disagree	22	26

Table 3 reveals that 23% of the students strongly agreed that a brain-based learning model will reduce the pace at which they learn while 27% strongly disagreed. This can be attributed to disparity in students' attitude toward learning which Brown (1994) noted that it starts with early childhood and is influenced negatively or positively by parents' level of role, peers, and type of people a student socializes with. Out of the 120 students, 33 admitted that students do not have the self-discipline to follow a self-paced program while another 49 respondents took the opposite stance (disagree and strongly disagree). An overwhelming 65% of students responded that the huge volume of work to be handled does not allow for the use of a brain-based learning model while 61% thought their lecturers do not know to handle a class designed according to a brain-based model. 43% of respondents agreed and strongly agreed that contact periods are too brief to allow for brain-based learning in the teaching of Physics. This reinforced the view of Jensen (2005) who stated that the duration of learning plays a significant role in brain rewiring from the traditional learning technique to brain-based learning.

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Table 4: percentage and frequency count on perceptions of students on the incorporation of brain-based techniques in the learning of Physics

S/N	Item Statement	N	Characteristics	%	Frequency
1	I prefer a Physics class that is engaging and fun	120	Strongly Agree	76	91
			Agree	15	18
			Disagree	6	7
			Strongly Disagree	3	4
2	I prefer learning about Physics by interacting with my classmates	120	Strongly Agree	49	59
			Agree	21	25
			Disagree	22	26
			Strongly Disagree	8	10
3	I want my learning to be self-paced	120	Strongly Agree	36	43
			Agree	28	34
			Disagree	25	30
			Strongly Disagree	11	13
4	I prefer a class that is tolerating, cooperative, and self-directed	120	Strongly Agree	13	16
			Agree	49	59
			Disagree	32	38
			Strongly Disagree	6	7
5	I prefer recesses between lecture periods	120	Strongly Agree	79	95
			Agree	11	13
			Disagree	7	8
			Strongly Disagree	3	4
6		120	Strongly Agree	69	83

I prefer mastering a topic before moving on to the next one	Agree	17	20
	Disagree	8	10
	Strongly Disagree	6	7

Section C of this questionnaire measures the perceptions of students on the incorporation of brain-based techniques in the learning of Physics. 76% of respondents asserted that they prefer a Physics class that is engaging and fun. Studies have identified that the use of traditional teaching methods, lack of teaching skill in brain-based learning, and the use of ineffective instructional approach frustrates students' attention to the learning of Physics' various principles (Onah and Ugwu 2010; Zewdie 2014; Wieman and Perkins 2005). Daniel et al. (2018) identified that the use of daily life examples, improvisation, group discussion, inductive approach, and previous knowledge approach engages the students in the lesson and makes teaching and learning an interesting activity. This was also confirmed by the outcome of this study which 49% strongly agreed (and another 21%) agreed that they prefer learning about Physics by interacting with their classmates. The question of whether students prefer a class that is tolerating, cooperative and self-directed also elicited varying responses. 13% of students strongly agreed that they want such a class while 49% agreed (only 6% strongly disagreed). Analyses also revealed that 36%, 79%, and 69% strongly agreed with the statements 'I want my learning to be self- paced', 'I prefer recesses between lecture periods', and 'I prefer mastering a topic before moving on to the next one' respectively.

In summary, several important findings can be deduced from the data. For lecturers, there are marked variations in the beliefs about the areas of Physics that can be taught using the brain-based model. The predominant belief is that fields such as Nuclear Physics, relativity, and quantum mechanics cannot be taught using this model. Lecturers also tend to believe that brain-based learning is compatible only with small class sizes, suitable for practical classes which are not supported by the present curriculum for Physics in the country. The implication of this is that the brain-based model, despite its potential is not considered ideal for teaching Physics in Nigeria without redesigning the curriculum and improving the learning environment. From the responses of the lecturers, the major constraints on the use of a brain-based model are the costs of implementing it and the fact that it can only be used for small class sizes. The responses of the students also point to the fact that a larger majority of them prefer a brain-based learning environment to the current teacher-focused mode of learning.

A key trend in the field survey is the need for awareness of the potential and merits of brain-based learning and its adaptability. While various constraints and perceptions on applicability has being expressed, it is important to note that the brain-based model has been noted by various researchers as having the potential for a tremendous positive impact on the learning process (Adeyemo, 2010; Amuche and Iyekekpolor, 2016; Jack et al, 2018). This potential is premised on the ability of brain-based learning to provide frameworks that allow learning to progress even in the face of individual learning strategies and capacities. The model also emphasizes confidence, meaningful content, adequate time, selection, and an enriched environment.

7. Study Limitations

This study was limited to respondents in four selected Colleges of Education in the Oyo state of Nigeria, therefore, the sample is not representative of the Nigerian educational system as a whole, as such generalizing the results of the study will be constrained by other local factors. This study's results were also influenced by the biases of respondents as responses and subsequent data and analyses were based on their perceptions at the time of the study, as such, it was identified that there is a need for further comparative and longitudinal studies to examine more comprehensively the application and constraints of brain-based learning and related factors.

8. Conclusions and Recommendations

This paper has examined the application and constraints of brain-based learning in the teaching of Physics in selected colleges of education. Lecturers have recognized that the brain-based learning model can be applied in certain aspects of Physics. The lecturers also noted that the model can be applied for practical classes and when the class size is small. This signified an awareness gap on the applicability of brain-based learning. Evidence from the study also showed that while the use of the model is not yet prevalent in Nigeria, students expressed a preference for some aspects of the model and also noted that the constraints on the utilization of the model would revolve around the lack of self-discipline on the part of students, the inadequacy of lecturers who are used to a teacher- focused mode of teaching and the huge volume of work which does not allow for the techniques of a brain-based model. The importance of brain-based learning in the teaching and learning of Physics cannot be over-emphasized. Nevertheless, improving the utilization of the model can be accelerated by adopting some of the recommendations below;

1. There is a need for policy orientation towards the use of brain-based learning methods and this can be achieved by basing the evaluation of teachers on their effectiveness in incorporating brain-based techniques in the teaching of the curriculum. The proviso that they would be evaluated in the use of these techniques provides a sustainable base upon which the practice can be spread.
2. Achieving the first recommendation and improving the effectiveness of brain-based models is predicated on the awareness of such models in the first place. As such, it is imperative that educational training in Nigeria should focus not only on curriculum and students' management but also on models such as brain-based learning in its practical dimension. This will help in assuring that teachers are equipped with the knowledge needed.

3. Stress and the perception of difficulty are two significant influences on the memory, learning, creativity, and behaviour of students. Brain-based learning can be used in remedying the negative effects of these influences by the design of classroom friendly environment which would decrease stress by incorporating such positive strategies as recess, integration stretching exercises, and teaching coping skills.
4. The vital recognition that the brain-based learning model and its techniques have demonstrated a positive impact on educational achievement and the learning process generally should serve as a rationale for using the model as the source of insight for educators, curriculum or syllabus designers, material developers, and course book designers who are also integral to Physics education in Nigeria.

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