INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY: APPLIED BUSINESS AND EDUCATION RESEARCH
2025, Vol. 6, No. 2, 770 – 786
http://dx.doi.org/10.11594/ijmaber.06.02.25

Research Article

Enhancing Instruction In Electronics: A Whole-Brain Approach Utilizing Differentiated Activities

John Kenneth C. Goyal[1]*, Eunice B. Custodio[2]

[1]College of Education, Valenzuela City Technological College, Kamagong St. Fortune Village VI, Parada, Valenzuela City
[2]Graduate School, Bulacan State University, McArthur Highway, Capitol Compound, Guinhawa, Malolos City 3000 Bulacan

Article history:
Submission 31 December 2024
Revised 07 February 2025
Accepted 23 February 2025

**Corresponding author:*
E-mail:
goyaljohnkennethcaranguian@gmail.com

ABSTRACT

Enhancing teaching strategies in teaching electronics contributes to Sustainable Development Goal 4 (Quality Education) by promoting inclusive and effective learning. Additionally, Priority Area 15 of the EDCOM 2 Year 2 Report highlights the importance of innovative pedagogical approaches to improve engagement and academic performance in higher education. This study evaluates the effectiveness of differentiated activities grounded in the whole-brain approach in teaching 80 first-year Electronics Technology students at Valenzuela City Technological College, selected through purposive sampling. Mean, percentage, standard deviation, and t-tests for correlated and independent samples were used for statistical analysis. Findings indicate that prior to implementing differentiated activities, students exhibited moderate engagement when taught using conventional methods. However, engagement significantly increased after the introduction of differentiated activities grounded on the whole brain approach. Pre-test scores for both control and experimental groups did not exceed 50%, indicating low student engagement and academic performance. In contrast, post-test scores improved significantly, confirming the effectiveness of differentiated activities grounded on the whole brain approach in teaching electronics. Despite the frequent use of differentiated strategies, instructors at Valenzuela City Technological College often overlook students' preferred learning styles, limiting the full potential of whole-brain instruction. These findings emphasize the need for instructional approaches tailored to diverse learning needs to maximize student engagement and academic success. In response, this study proposes a training plan for college instructors to enhance the application of differentiated activities grounded on the whole brain in teaching electronics education.

How to cite:
Goyal, J. K. C. & Custodio, E. B. (2025). Enhancing Instruction In Electronics: A Whole-Brain Approach Utilizing Differentiated Activities. *International Journal of Multidisciplinary: Applied Business and Education Research*. *6*(2), 770 – 786. doi: 10.11594/ijmaber.06.02.25

***Keywords**: Differentiated Activities, Whole Brain Teaching, Students Learning Engagement, Four Quadrants of the Brain, Holistic Learning,*

Introduction

Background

The United Nations Educational, Scientific and Cultural Organization (UNESCO) advocates for the implementation of technical-vocational education in developing countries as a strategy to promote economic growth, reduce poverty, and achieve Sustainable Development Goal 4 (Quality Education). Countries with emerging economies, such as China, Brazil, and Chile, have prioritized technical-vocational schools to deliver quality education and facilitate a smooth transition from academics to careers (Sontillano, 2018). In recent years, these nations have significantly increased their investments in vocational education. However, the long-term impact on educational outcomes remains uncertain. According to Dougherty (2018), research indicates that technical-vocational education can enhance student performance, engagement, and retention, reduce dropout rates, and increase college enrollment. Critics, however, contend that vocational education may be too narrow in scope, potentially limiting further educational opportunities and hindering economic growth in developing nations. Additionally, empirical evidence regarding its effectiveness in improving cognitive skills is insufficient when compared to traditional academic institutions. The Program for International Student Assessment (PISA) has reported that students in technical-vocational programs often demonstrate lower general skills than their counterparts in traditional academic tracks (Sontillano, 2018).

According to the Ramos (2024), the ASEAN region's varied educational systems are a reflection of the distinct historical, cultural, and economic backgrounds of its member nations. Over the past few decades, many ASEAN nations have improved their literacy rates and increased access to quality education. There is reason for hope given the advancements made in nations like Vietnam and Thailand, which are concentrating on attaining universal primary education, as well as Singapore and Malaysia, which have strong educational institutions. But in places like Myanmar, Cambodia, and Laos, where poverty and poor infrastructure continue to be major obstacles, unequal access to quality education still exist, especially in remote and marginalized groups (Jamaludin et al, 2020).

Ryuhei (2020) stated that the ASEAN Work Plan on Education 2021-2025, which seeks to expand technical-vocational training, integrate digital learning, and promote inclusive and equitable education, is one example of how ASEAN is working together to improve education. The importance of mutual recognition of qualifications in enhancing mobility within the ASEAN labor market has been highlighted by regional collaboration. However, quality education is still hindered by challenges such as unequal access to education, technology gap, and inadequate financing for public schools. It is substantial to address these issues to foster workforce capacity improvements and ensure that the ASEAN region remains competitive and resilient in the face of worldwide economic and technological transitions.

In the Philippine context, the EDCOM 2 report highlights key challenges in technical-vocational education, particularly concerning international competitiveness, curriculum alignment with industry needs, and access to high-quality training facilities. The report underscores the necessity for a stronger connection between vocational education and labor market demands, ensuring that graduates acquire skills that translate into meaningful employment opportunities. As the government advocates for education reform and workforce development, addressing these concerns is crucial to maximizing the benefits of technical-vocational education and enhancing the country's global standing in skills-based industries.

The literacy rate of the Philippines has dramatically dropped over the past decade as reported by the EDCOM Year II Report. The Constitution guarantees all Filipinos the right to education; however, the quality, relevance, and accessibility of that education are deteriorating. Despite the Department of Education's reported achievements, such as an increase in the number of classrooms, numerous challenges persist. These include an overcrowded classroom ratio of 1:70, diminishing student aptitude, and decline in the values of the youth, all of which hinder the advancement of the country's educational system. The Philippine education system continues to face range of issues, despite legislative efforts, financial priorities, and expanded access. While improvements have been observed in recent years, several problems remain unresolved. These include rising dropout rates, an increasing number of repeat students, declining passing grades, insufficient communication skills, inadequate attention to students with specific needs, overcrowded classrooms, and teachers who are unable to manage their workloads. Consequently, many Filipinos lack basic literacy skills, youth drop out of school, and college graduates often do not possess the skills necessary to succeed in the workforce.

Teaching electronics as an integral component of technical-vocational strand, and technology, and livelihood education presents significant challenges. According to the Technical Skills Development Authority's training regulations, it is imperative to balance the emphasis on cognitive, psychomotor, and affective domains of learning. However, many trainers or instructors often overlook the students' diverse needs, which can hinder effective learning. Since students are assessed through demonstrations, written tests, and oral examinations during the national assessment, trainers may prioritize performance in assessments over tailoring training to accommodate individual learning differences. Nonetheless, recognizing individual differences is crucial for fostering successful and meaningful interactions among learners. Every classroom comprises diversity of students, all of whom must be supported (Gregory and Chapman, 2015). As noted by Aranda and Zamora (2016), diversity is essential in every educational setting. Each classroom contains individuals with unique perspectives and characteristics who are eager to learn, and teaching these students poses a challenging task for educators. Gregory and Chapman (2015) underscore the importance of teachers to understand the most effective learning strategies for their students to address their diverse needs.

The challenge of engaging technical-vocational students in discussions prompted the researchers to combine strategies to create a more effective approach for enhancing student engagement. Differentiated activities and whole-brain approach to education proved to be helpful in identifying effective instructional methods that could improve students' academic performance, foster maximum participation, and engage them in various activities. Combining these methodologies will enable the researchers to optimize student involvement in meaningful discussions about electronics.

Methods

Research Design

This study utilized a quantitative research approach, more specifically the descriptive and experimental research method. A survey was done using the descriptive method to assess the level of student learning engagement before and after implementing differentiated activities based on the whole brain teaching approach. Additionally, a survey was done with ValTech instructors on how often they employ differentiated activities grounded on the whole brain teaching approach in their classes. An experimental study was undertaken to enhance the discussion with students. The experimental group was taught utilizing differentiated activities grounded on the whole brain teaching approach, whereas the control group was taught using the conventional or traditional teaching style. The pretest and post-test scores of the students were subjected to statistical analysis in order to ascertain the presence of a significant difference and to evaluate the impact of the differentiated activities based on the whole brain teaching method on the learners' level of involvement in the learning process.

Research Participants

The researchers employed a purposeful sampling methodology in conjunction with the quantitative experimental method to ascertain the participants. Selecting suitable participants for the research is crucial for the outcomes and discoveries of the study. The study focused on the population of first-year students enrolled in the Electronics Technology Department (EST) at Valenzuela City Technological College (ValTech). The respondents consisted of forty (40) first-year section A students, comprising 25 males (62.60%) and 15 females (37.50%) in the experimental group. In the control group, there were 24 males (60.00%) and 16 females (40.00%), making a total of 40 first-year section B students.

The faculty members of Valenzuela City Technological College also participated in a survey assessing their perception and how often the utilize differentiated activities grounded in the whole brain approaching their classes. The faculty members also participated in a seminar workshop on retooling, specifically focused on differentiated activities grounded in the whole brain approach. The faculty members were composed of five (5) Automotive Technology instructors (4.90%), six (6) Civil Technology instructors (5.88%), six (6) Electronics Technology instructors (5.88%), six (6) Electrical Technology instructors (5.88%), eight (8) Food Service and Management instructors (7.84%), five (5) Garments and Fashion Design instructors (4.90%), four (4) Heating, Ventilating, Airconditioning Technology instructors (3.92%), four (4) Welding and Fabrication Technology instructors (3.92%), seven (7) National Service Training Program (6.86%), five (5) Physical Education instructors (4.90%), nineteen (19) General Education instructors (18.63%), and twenty seven (27) Professional Education instructors (26.47%) with a total of 102 ValTech instructors.

Research Instruments

The instructors of the Electronics Technology Department have developed a syllabus that incorporates differentiated activities based on the whole brain teaching approach. This syllabus has been approved by the program coordinator and the dean of the College of Education. The Learner Characteristics Profile form was utilized to gather information on the backgrounds and characteristics of the learners. The written tests administered were the departmentalized examination in Electronics, which has been validated by the program chairperson and electronics technology instructors in accordance with the Training Regulation for Electronic Products Assembly and Servicing NCII qualifications.

The researcher utilized an adapted and modified survey questionnaire intended to assess the students' learning engagement level before and after implementing differentiated instructions grounded in the whole brain approach and to assess the perception of ValTech instructors on the frequency at which they integrate differentiated activities and whole brain approach in their discussion. The questionnaires were based on the questionnaires developed by Hart et al. (2011) in their study titled, "The Student Engagement in Schools Questionnaire (SESQ)" and the questionnaire developed by Onyishi and Sefotho (2020) in their study titled, "Teachers' Perspectives on the Use of Differentiated Instruction in Inclusive Classrooms: Implication for Teacher Education".

Data Analysis

Real statistics software for data analysis was used for determining the mean, standard deviation, t-test for correlated samples and independent samples. Mean was calculated to determine the disparity of the pretest and posttest scores and to evaluate the degree of students' learning engagement prior to and during the execution of differentiated activities grounded in the whole brain approach. It was also utilized to assess the perception of ValTech instructors and the frequency with which they integrate differentiated activities and whole brain approach in their discussion. The standard deviation was used to examine the degree of dispersion and variability of the responses. The t-test for correlated samples was employed to ascertain whether there exists a statistically significant disparity in the pretest and posttest scores between the controlled and experimental group who were instructed utilizing the conventional teaching method and the differentiated activities grounded on the whole brain approach. Alternatively, a t-test for independent samples was employed to ascertain whether there was significant disparity in the posttest results between the control group andexperimental group. The result was analyzed based on the 0.05 level of significance.

Theoretical Framework

Whole Brain Learning and Neuroscience

Mugot (2019) highlighted establishing and developing the whole-brain theory idea and the Hermann Brain Dominance Instrument (HBDI). Ned Hermann developed the whole-brain model which is a blend of Roger Sperry's "Split-Brain Theory" and Dr. Paul Mclean's "Triune Brain Theory", which concentrates on the four quadrants of the brain (O'Neill, 2018).

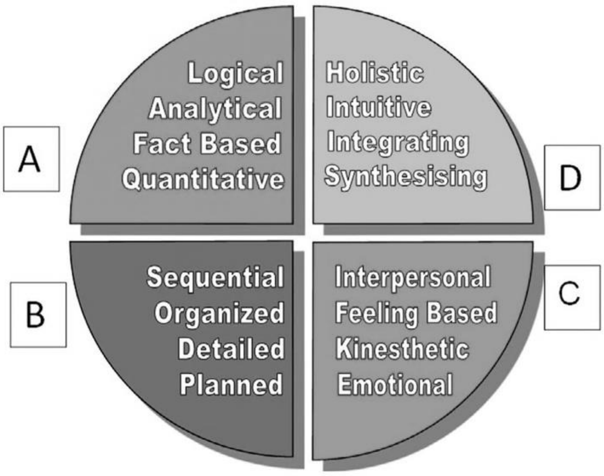

Figure 1. Four Quadrants of the Brain

According to Bawaneh et al., (2019), if learners only develop learning in one or two quadrants of the brain, they may reject learning in the other quadrants. This concept highlights a strong need to utilize each learner's strength and resolve any substantial inadequacies by providing all students with equal and maximum opportunities to learn and combine all four learning styles into a single session.

This whole-brain concept served as the basis for how individualized teaching and various approaches will be used to achieve maximum levels of student engagement. This approach was geared towards conceptualizing variety of activities in electronics using a holistic approach that aims to engage all four quadrants of the brain, as outlined in whole brain theory.

Differentiation and Students Diversity

According to Bouchrika (2022), it is very improbable that the needs of all children will be addressed using the one-size-fits-all strategy prevalent in schools. Consequently, students who had difficulty may have lost their will to study, whereas students who were not challenged enough may have lost interest in the subject matter. Because of this, customized education was designed to cater to the various educational needs of learners within the confines of a single classroom setting.

It is vital that every instructor uses instructional tactics aimed at giving students a variety of learning opportunities. The theory that underpins differentiated teaching served as one of the foundations of developing this new strategy which purpose is to obtain the highest possible level of participation from students. In addition, one of this study's primary objective was to provide a number of different avenues for students to investigate various aspects of electronic subjects.

Conceptual Framework

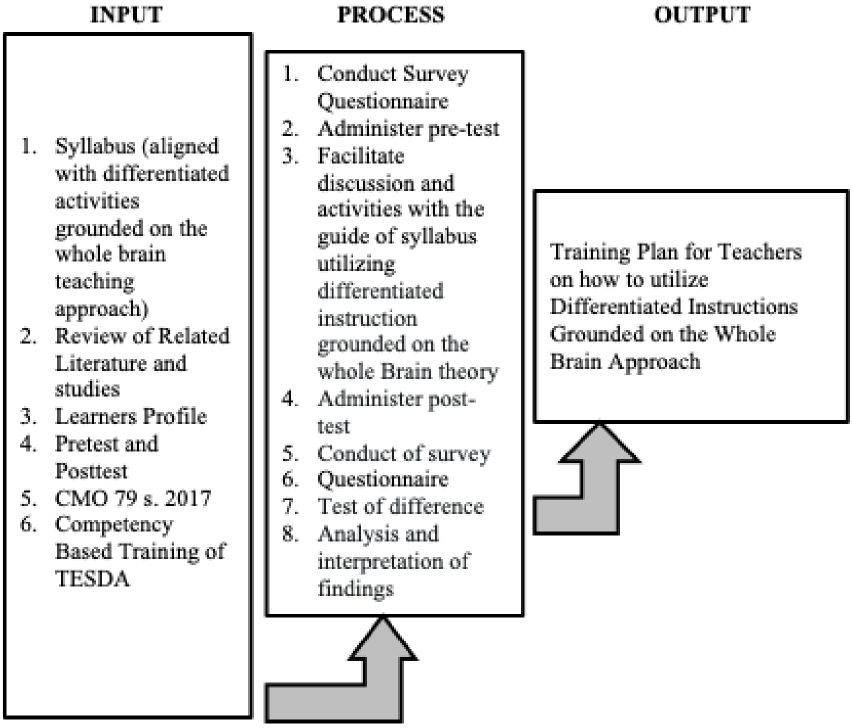

Figure 2. The Research Conceptual Framework

Result and Discussion

PART I. Before The Implementation of Differentiated Activities Grounded on The Whole Brain Approach

After all the necessary forms were accomplished, the researcher commenced on the experimentation during the final term of the first semester of the school year 2023-2024. There were three topics identified as stipulated in the syllabus before the end of the semester namely Diode, Transistor, and Power Supply assembly and disassembly. The researcher employed the traditional teaching method to instruct the EST first year section B (controlled group) students. The researcher begins with utilizing traditional visual instructional materials and an interactive discussion followed by the individualized learning as outlined in the Competency Based Training of TESDA. The students were assessed through demonstration, oral recitation, and written test as prescribed by TESDA.

On the other hand, the EST first year section A (experimental group) students was taught using the differentiated activities grounded by the whole brain teaching approach. Each topic in Electronics was accompanied by four activities, designed to help students gain mastery in learning various concepts. These activities aim to develop the four quadrants of the brain, namely analytical thinking (quadrant A), sequential thinking (quadrant B), practical and interpersonal thinking (quadrant C), and experimental and imaginative thinking (quadrant D), as outlined in the whole brain theory.

During the first week, the researcher began by engaging the students in a "Gallery Walk" activity, where they studied the different types of diodes posted on the wall and they viewed a video showcasing the functions of different types of diodes at the end of the gallery. This activity aimed to assess the students' analytical thinking skills. Following the video, the researcher facilitated a brief interactive discussion to ensure that the students had a solid understanding of the concepts. Subsequently, the researcher formed diverse groups of students and assigned them sequential or procedural tasks related to diode troubleshooting. Following this, the students completed the task by following each step precisely. They are advised to scrutinize the methods thoroughly and detect any potential shortcuts when it comes to troubleshooting diodes. To enhance learner motivation, incentives will be granted to those individuals who can provide a workaround or shortcuts for troubleshooting diodes that does not compromise the final product or outcome. To enhance the students' Interpersonal thinking skills, the researcher employed the same groupings and provided the students with a collection of circuit boards. The students, working together in their respective groups, were tasked with collectively identifying diodes among the many components mounted on the circuit boards. To finish the tasks during the initial week, the researcher instructed the students to engage in experiments involving the processes of mounting, soldering, and troubleshooting diodes. The researcher evaluated the students' performance, written test results, and communication abilities through oral examination during the experimentation process.

In the second week, the researcher facilitated an interactive discussion with the students on transistors using a component analysis activity. The students examined many types of transistors that were incorporated in a collection book and meta cards. The purpose of this task was to evaluate the students' capacity for critical thinking regarding the many types and functions of transistors. Afterwards, the researcher created heterogenous groups of students and allocated them sequential or procedural tasks that were connected to troubleshooting transistors. The students diligently followed each step-in order to successfully finish the task, and they were urged to thoroughly analyze the techniques and identify any efficient approaches in resolving transistor issues. Following this, in order to enhance learner motivation, incentives will be granted to those individuals who can provide a workaround or shortcuts for troubleshooting transistors that does not compromise the final product or outcome. In order to improve the students' Interpersonal thinking skills, the researcher utilized identical groupings and supplied the students with a set of circuit boards. The students collaborated in their individual groups to jointly identify transistors and their many varieties among the numerous components installed on the circuit boards. To complete the tasks during the second week, the researcher directed the students to participate in experiments that encompassed the procedures of mounting, soldering, and troubleshooting transistors. The researcher assessed the students' performance, written test scores, and communication skills through oral examinations during the experimentation phase.

During the third week, the researcher presented a comprehensive explanation of the procedures involved in comprehending and recognizing the interrelationships among various elements depicted in a schematic diagram. The students were instructed to trace each of the links represented by the symbols and convert these schematic symbols into blocks in order to construct a concise and straightforward block diagram. In order to facilitate the learners' understanding of sequential and procedural activity, the researcher supplied the students with instructional resources, namely a connecting puzzle. This puzzle required the students to connect each piece of model components in the correct order, thereby creating a schematic representation of a power supply. To enhance the students' Interpersonal thinking skills, the researcher formed diverse groups of students and instructed them to create the design of the schematic diagram on the printed circuit board and etch the PCB using ferric chloride. After completing the etching process, each group will advance to the experimentation phase. This involves mounting and soldering the components onto the PCB and then evaluating the operation of the product. In order to assure a thorough comprehension by the learners, they were instructed to independently replicate the same procedure and showcase their separately crafted power supply designs.

Table 1. The Students' Level of Learning Engagement Prior to the Utilization of Differentiated Activities in Teaching Electronics Grounded in the Whole-Brain Approach.

Indicator (Quadrant)	Weighted Mean	SD	Descriptive Interpretation
Analytical Thinking (A)	3.30	0.55	Moderately Engaged
Sequential Thinking (B)	3.32	0.75	Moderately Engaged
Practical and Interpersonal Thinking (C)	3.21	0.72	Moderately Engaged
Experimental and Imaginative Thinking (D)	3.29	0.51	Moderately Engaged
Total Mean	**3.28**	**0.62**	**Moderately Engaged**

As shown in the table, the indicator "Sequential Thinking" had the highest computed mean of 3.32. This is descriptively interpreted as "Moderately Engaged" with a standard deviation of 0.75 while the indicator "Practical and Interpersonal Thinking" had the lowest computed mean of 3.21, descriptively interpreted as "Moderately Engaged," with a standard deviation of 0.72. The students' level of learning engagement prior to the utilization of differentiated activities in teaching Electronics, grounded in the whole-brain approach, received an overall mean of 3.28. This is descriptively interpreted as "Moderately Engaged" with a standard deviation of 0.62, indicating a moderately high variability in students' responses. The result presents the students' perception of how they performed and engaged in the conventional teaching approach, leading to an overall result of moderate engagement in all activities involving the four quadrants of the brain.

PART II. After The Implementation of Differentiated Activities Grounded on The Whole Brain Approach

Upon completing the instructional sessions, the participants underwent the administration of the post-test followed by the administration of the post survey assessing the level of learning engagement of the learners after the utilization of differentiated activities grounded on the whole brain approach. The data obtained from the pre- and post-tests were examined and aggregated to see if there is a significant increase on the level of learning engagement of the students after the utilization of differentiated activities grounded on the whole brain approach.

Table 2. The Summary of the Students' Level of Learning Engagement After the Utilization of Differentiated Activities in Teaching Electronics Grounded in the Whole-Brain Approach.

Indicator (Quadrant)	Weighted Mean	SD	Descriptive Interpretation
Analytical Thinking (A)	4.63	0.39	Highly Engaged
Sequential Thinking (B)	4.68	0.38	Highly Engaged
Practical and Interpersonal Thinking (C)	4.70	0.40	Highly Engaged
Experimental and Imaginative Thinking (D)	4.67	0.44	Highly Engaged
Total Mean	**4.67**	**0.40**	**Highly Engaged**

As shown in the table, the indicator "Practical and Interpersonal Thinking" acquired the highest computed mean of 4.70 descriptively interpreted as "Highly Engaged" with standard deviation of 0.40 while the indicator "Analytical Thinking" obtained the lowest computed mean of 4.63 descriptively interpreted as "Highly Engaged" with standard deviation of 0.39. The students' level of learning engagement after the utilization of differentiated activities in teaching Electronics grounded in the whole-brain approach received a general weighted mean of 4.67 descriptively interpreted as "Highly Engaged". with a standard deviation of 0.40. The result indicates that the perception of most of the Electronics Technology students showed that they highly engaged in the discussions employing differentiated activities grounded on the whole brain approach, leading to an overall result of highly engaged in all the activities that involve the four quadrants of the brain. Several studies have demonstrated that differentiated instruction grounded in the whole brain approach has a significant impact on students' academic success and motivation to learn. According to the scholarly work of Andaya (2014), effective classroom education holds promise in mitigating the various challenges commonly encountered in the realm of learning and instruction in electronics. Consequently, educators are responsible for developing instructional strategies that address these needs. The educational methodology known as "brain-based learning" aims to facilitate the comprehensive development of students' cognitive, social, physical, and introspective capacities (Sesmiarni, 2015). Sanchez (2017) indicates that research has shown incorporating brain-based exercises into educational practices can enhance students' cognitive capacities, particularly in knowledge processing and retention. Therefore, it is advisable for educators to integrate these exercises into their teaching methodologies. Sontillano (2018) asserts that instructors need an understanding of each educational model to better serve their students by tailoring lessons to each group's preferred learning approaches. The most effective teaching methods are those that consider the brain's function in the learning process, such as Brain-Based Learning (BBL) and Whole Brain Teaching (WBT).

Table 3. The Pre-Test and Post Test Scores of the First Year Section A (Experimental Group) and First Year Section B Electronics Technology Students (Control Group).

The Pre-Test and Post-Test Scores of the Control Group (EST 1-B			*The Pre-Test and Post-Test Scores of the Experimental Group (EST-1A)*		
Average	**26.075**	**45.1**	**Average**	**27.375**	**51.825**
	40.46%	75.17%		45.63%	86.38%
Gain	**19.025**		**Gain**	**24.45**	

As presented in the table, prior to instructing the control group using the traditional teaching approach, the students completed a pretest, achieving an average raw score of 26.075, or 40.46%. The average post-test scores increased by 45.1, representing 75.17% of the total number of items, with an average improvement score of 19.025. Conversely, the experimental group, which was taught using differentiated activities grounded based on the whole brain approach, attained an average raw score of 26.075, or 45.63%. Their average post-test scores increased by 51.825, accounting for 86.38% of the total number of items, with an average improvement score of 24.45.

In light of the evolving education system and the integration of technology, this approach no longer sufficiently meets the needs of students. Nevertheless, many educators lack the knowledge and expertise necessary to effectively accommodate their students' diverse learning preferences. Additionally, some educators hold the misconception that they have limited time available, which can lead to inefficient use of their time (Onyishi & Sefotho, 2020). According to Bogen et al. (2019), providing tools and encouragement to instructors can foster a sense of confidence in implementing diversified teaching strategies, potentially resulting in improvements in student achievement. On the other hand, the study conducted by Smith (2018) offers educators a variety of approaches to assess student development and the effectiveness of differentiated teaching in enhancing learning outcomes for students from diverse backgrounds. Progress can be measured through various methods, including pre- and post-testing of topic mastery and qualitative approaches such as student surveys, interviews, and focus groups. Both strategies should be employed for optimal results. Similarly, Conderman and Hedin (2014) provide further recommendations for incorporating student self-assessments of their participation levels, knowledge, skills, and overall engagement. Rubrics not only facilitate the evaluation of progress but also assist students in developing independent learning skills. In alignment with this study, the research conducted by Macalapay (2019) demonstrates that standardized test scores improved significantly more for middle school students whose teachers employed differentiated instruction following the intervention, compared to a control group taught using traditional methods. This study illustrates the feasibility of accurately evaluating the benefits of a diverse educational experience through quantitative assessment instruments, highlighting the value of exposing students to various learning environments.

Table 4. The Significant Difference on the Pre-Test and Post Test Scores of the First Year Section B Electronics Technology Students (Control Group).

Pre-Test vs. Post-Test			Alpha	0.05		
	t-stat	**df**	**p-value**	**t-crit**	**Decision**	**Descriptive Interpretation**
Two Tail	-23.2899	39	.0000	2.0227	Reject Ho	Significant

As shown in the table, the pre-test and post test result of the control group obtained a t-statistics value of -23.2899 which is larger than the t-critical value of 2.0227 receiving a p-value of .0000 which is lower than the alpha of 0.05 that leads to the decision of rejecting the null hypothesis descriptively interpreted as significant.

Table 5. The Significant Difference on the Pre-Test and Post Test Scores of the First Year Section A Electronics Technology Students (Experimental Group)

Pre-Test vs. Post-Test			Alpha	0.05		
	t-stat	**df**	**p-value**	**t-crit**	**Decision**	**Descriptive Interpretation**
Two Tail	-40.1712	39	.0000	2.0227	Reject Ho	Significant

As shown in the table, the pretest and post test result of the experimental group obtained a t-statistics value of -40.1712 which is larger than the t-critical value of 2.0227 receiving a p-value of .0000 which is lower than the Alpha of 0.05 that leads to the decision of rejecting the null hypothesis descriptively interpreted as significant.

Table 6. The Significant Difference on the Post Test Scores of the First Year Section A and B Electronics Technology Students.

Post-Test vs. Post-Test			Alpha	0.05		
	t-stat	**df**	**p-value**	**t-crit**	**Decision**	**Descriptive Interpretation**
Two Tail	5.2239	78	.0000	1.9909	Reject Ho	Significant

As shown in the table, post test results of the first-year section A and B electronics technology students obtained a t-statistics value of 5.2239 which is larger than the t-critical value of 1.9909 receiving a p-value of .0000 which is lower than the level of significance of 0.05 that leads to the decision of rejecting the null hypothesis descriptively interpreted as significant. The present study aligns with the quasi-experimental investigation conducted by Smith (2018), which aimed to examine students' perceptions of Whole Brain Teaching (WBT) and its impact on academic attainment and motivation. The findings indicated a significant improvement observed in both the control and experimental groups between the pretest and posttest assessments. The WBT group demonstrated a noteworthy enhancement in the engagement-related questions of the motivation questionnaire. Students' responses to WBT reflected a widespread acceptance of the approach and its key characteristics. The rapid pace of change in electronics education necessitates effective training programs, and educators can support student success by focusing on their strengths and encouraging greater involvement in the classroom to address deficiencies. In conclusion, the findings of these experimental investigations suggest that tailoring course materials and activities to individual student interests may be an effective strategy for enhancing student engagement and academic achievement in higher education. This study employs interest-based differentiation within the context of electronics education to actively integrate students from diverse backgrounds.

PART III. Survey on the Faculty Members

The faculty members of Valenzuela City Technological College were surveyed to gauge the perception of ValTech instructors and the frequency at which they integrate diverse activities based on the whole brain approach in their classes. The faculty members also participated in a seminar workshop on retooling, specifically focused on differentiated activities rooted in the whole brain approach. This workshop aimed to demonstrate that the application of differentiated activities extends beyond the teaching of electronics. Each faculty member designed their syllabus with activities aimed at fostering development in all four quadrants of the brain. Following the implementation of their conversation, driven by the syllabus prepared with differentiated activities grounded in the whole brain approach, the faculty members evaluated their perception of employing differentiated activities based on the Whole Brain Approach.

Table 7. Perception of Teachers on their Utilization of Differentiated Activities Grounded in the Whole Brain Approach.

Statements	Mean	SD	VI
1. I provide my students with a diverse range of learning options to optimize their learning experience.	3.51	0.59	Often
2. I utilize pedagogical approaches that enable students to effectively utilize their sensory faculties.	3.93	0.58	Often
3. I provide appropriate cognitive engagement for students with learning difficulties as well as those who demonstrate outstanding aptitude.	4.13	0.54	Often
4. I facilitate highly interactive activities that offer my students the opportunity to engage in collaborative work with their peers.	4.29	0.61	Always
5. I grant my students the autonomy to engage in self-directed tasks and pursue individual pursuits.	4.09	0.56	Often
6. I provide activities that promote students' active involvement with the subject matter and encourage practical, experiential learning.	4.47	0.50	Always
7. I provide students with tasks that facilitate the establishment of linkages between concepts and everyday facts or human experiences.	3.75	0.94	Often
8. Prior to the start of the lesson, I methodically gather data to determine the distinct attributes and preferred methods of learning of my students.	2.41	0.67	Rarely
9. I conduct activities that demonstrate the analytical and logical reasoning skills of my students.	4.25	0.43	Always
10. Prior to allowing my students to work independently, I consistently ensure that I present them with a series of sequential and procedural tasks.	4.32	0.47	Always
11. I constantly facilitate the comprehensive and integrated acquisition of knowledge by my students using various instructional materials and technology tools in my lessons.	4.31	0.70	Always

Statements	Mean	SD	VI
12. I provide my students with a diverse range of options to showcase their gained knowledge and effectively exhibit their understanding of the material covered in class.	3.88	0.65	Often
13. I consistently employ authentic assessment.	3.84	0.73	Often
14. I tailor exercises to align with the specific attributes and specific needs of my students.	2.66	0.98	Sometimes
15. I implement activities that brings out the creativity on my students	4.29	0.46	Always
16. There are several technological tools and instructional resources available in school for educators to utilize and access in the context of teaching and learning.	3.65	0.67	Often
TOTAL	3.86	0.55	**Often**

As presented on the table, item "I provide activities that promote students' active involvement with the subject matter and encourage practical, experiential learning." received the highest computed mean of 4.47 with a standard deviation of 0.50 descriptively interpreted as "Always" while the item "Prior to the start of the lesson, I methodically gather data to determine the distinct attributes and preferred methods of learning of my students." received the lowest computed mean of 2.41 with a standard deviation of 0.67 descriptively interpreted as "Rarely". The perception of ValTech's instructors on their utilization of differentiated activities and the whole brain approach acquired a general weighted mean of 3.86 descriptively interpreted as "Often" with a standard deviation of 0.55. Every classroom contains young individuals with distinct perspectives and qualities, who are enthusiastic about learning (Aranda and Zamora, 2016). Most of educators fail to consider the attributes of their learners, leading to a persistently poor level of student engagement and academic performance. Each classroom comprises a diverse array of students, all of whom should receive equal attention and support (Gregory & Chapman, 2015).

Proposed Training Plan on the Utilization of Differentiated Instructions Grounded on the Whole Brain Approach in Teaching Electronics

Rationale

Aranda and Zamora (2016) assert that diversity is an essential prerequisite in any classroom. Every classroom comprises young individuals with distinct perspectives and qualities, who are enthusiastic about learning. Teaching a varied group of students poses a significant challenge for educators. According to Gregory and Chapman (2015), teachers need to possess a comprehensive understanding of their students' optimal learning methods in order to cater to the needs of a varied student body. ValTech's instructors frequently employed differentiated activities when teaching their assigned subjects, as indicated by the study's findings. Nevertheless, they fail to consider the attributes of their learners, leading to a persistently low level of student engagement and academic achievement. In order to promote effective and significant discussions among learners, it is important to take into account differences in individuals. Each classroom comprises a diverse array of students, all of whom should be given equal attention and support (Gregory and Chapman, 2015). Based on the study's findings, because the ValTech instructors often neglect to determine the characteristics of the learners and tailor these activities based on learner's characteristics, the ValTech academic coordinators designed a program where instructors will be trained to align their implemented activities based on the needs of the learners. The program aims to create a comprehensive strategy that addresses the individual needs of students in order to enhance their analytical thinking (quadrant A), sequential or procedural thinking (quadrant B), interpersonal thinking (quadrant C), and experimental thinking (quadrant D).

Title

Training Plan on the Utilization of Differentiated Instructions Grounded on the Whole Brain Approach in Teaching Electronics

Introduction

Improving the motivation of students to learn is one of the current education system's primary concerns. Several teaching strategies, techniques, and methods have been developed to address the problem of low levels of student engagement in learning. Differentiated instruction and the whole brain teaching approach have been proven to be two of the most effective tools for increasing student engagement in learning. According to studies, the combination of these two methodologies has a significant impact on students' academic performance and learning engagement.

Purpose

After the training/workshop for Utilization of Differentiated Instructions Grounded on the Whole Brain Approach in Teaching Electronics, the participants are expected to:

a. determine differentiated activities grounded on the whole brain teaching approach that can be utilized in their respective handled subjects.
b. integrates activities in the syllabus designed with differentiated instructions grounded on the whole brain approach.
c. demonstrate the use of the strategies or activities designed with differentiated instructions grounded on the whole brain approach.

Steps in Integrating and Utilizing of Differentiated Instructions Grounded on the Whole Brain Approach in Teaching Electronics

Step 1. Identify strategies and activities in teaching the handled subjects.

The first step in the process of developing differentiated techniques and activities using the whole brain approach is to identify the precise areas within a subject or discipline where a teacher can integrate differentiated instruction based on the whole brain approach. To familiarize educators with differentiated instruction based on the whole brain approach, it is necessary to begin with an introduction to differentiated instruction. Subsequently, the most prevalent differentiated activities in teaching should be presented. Lastly, to facilitate the effective implementation of the whole brain teaching approach, it is imperative that teachers are provided with comprehensive instruction on how to incorporate this methodology into their subject areas. This will enable them to develop and deliver well-structured presentations that align with the planned activities.

Step 2. Design differentiated activities grounded on the whole brain approach.

Once the areas of the discipline where a teacher can incorporate differentiated instruction based on the whole brain approach have been determined and identified, it is necessary for the teacher to proceed with the classification of activities. This classification involves categorizing the activities into four distinct quadrants: Analytical Thinking (Quadrant A), Sequential Thinking (Quadrant B), Practical and Interpersonal Thinking (Quadrant C), and Experimental and Imaginative Thinking (Quadrant D).

Step 3. Integrate the differentiated instructions grounded on the whole brain teaching approach in the syllabus.

After the classification of activities has been completed, it is imperative for teachers to commence the process of integrating those activities into the syllabus. It is imperative for educators to ensure that each activity aligns with an adequate assessment of learning. In addition, it is imperative for educators to incorporate the anticipated results of each of the instructional activities.

Step 4. Demonstrate the utilization of differentiated instructions grounded on the whole brain teaching approach.

Upon finalizing the activities outlined in the syllabus, educators are expected to commence the implementation of those activities. Following the completion of the activities, it is imperative for the instructor to commence the evaluation process in order to analyze the efficacy of the activity. This evaluation entails gauging the level of student participation and their academic success.

Table 8. Proposed Training Plan on the Utilization of Differentiated Instructions Grounded on the Whole Brain Approach in Teaching Electronics

EXPECTED OUTCOME	TRAINING ACTIVITIES	PERSON INVOLVED	TIME FRAME
I. Analyze the characteristics of the learners and determine their specific learning needs. *Topics:* *a. Different learners' characteristics* *b. Learning styles* *c. Multiple intelligence*	Interactive Discussion of Learners Characteristics Profile form Presentation of best teaching strategies for each learning styles and multiple intelligence	Faculty and Employee Association Facilitators Program head and Co-ordinators Faculty members	4 hours
II. Identify strategies and activities in teaching the handled subjects. *Topics:* *a. Introduction to differentiated instruction.* *b. Most common differentiated activities in teaching* *c. The whole brain teaching approach*	Interactive Discussion Brainstorming *(Per subject area)* Determining possible activities in teaching their respective handled subjects	Facilitators Program head and Co-ordinators Faculty members	4 hours
III. Design differentiated activities grounded on the whole brain approach. *Classify each of the determined activities if it exhibits mastery in the following parameters:* *a. Analytical Thinking* *b. Sequential Thinking* *c. Interpersonal Thinking* d. *Imaginative and experimental Thinking*	Interactive Discussion Brainstorming *(Per subject Area)* Classifying activities with the four quadrants of the brain	Facilitators Program head and Co-ordinators Faculty members	4 hours
IV. Integrate the differentiated instructions grounded on the whole brain teaching approach in the syllabus	Interactive Discussion Brainstorming *(Per subject Area)* Syllabus making	Facilitators Program head and Co-ordinators Faculty members	4 hours
V. Demonstrate the utilization of differentiated instructions grounded on the whole brain teaching approach	Interactive Discussion Brainstorming *(Per subject Area)* Teaching Demonstration	Facilitators Program head and Co-ordinators Faculty members	1 day

Conclusions

Conclusions were drawn based on the study's findings. The summary of the students' level of learning engagement prior to the utilization of differentiated activities in teaching Electronics, grounded in the whole-brain approach, received a general weighted mean of 3.28, which is descriptively interpreted as "Moderately Engaged," with a standard deviation of 0.62. This result indicates that the weighted mean of the responses from the moderately engaged learners varies and spreads out from 3.28 ± 0.62, or within a range of 2.66 to 3.90. In contrast, the summary of the students' level of learning engagement after the utilization of differentiated activities in teaching Electronics, also grounded in the whole-brain approach, received a general weighted mean of 4.67, descriptively interpreted as "Highly Engaged," with a standard deviation of 0.40, indicating moderate to low variability in students' responses. This result shows that the weighted mean of the responses from the highly engaged learners varies and spreads out from 4.67 ± 0.40, or within a range of 4.37 to 5.00. According to the results of the pre-test and post-test scores of the first-year sections A and B in Electronics Technology, the average raw score of the pre-test did not even reach half of the total number of items, which is 60, while the post-test average showed a significant increase in scores out of 60. There was a significant increase in the pre-test and post-test scores of the first-year section B Electronics Technology students (control group) when instructed using the traditional teaching method. In contrast, the pre-test and post-test scores of the first-year section A Electronics Technology students (experimental group) exhibited significant improvement when taught using differentiated activities grounded in the whole-brain approach. Furthermore, there is a significant disparity in the post-test results between the first-year students who were instructed using the traditional teaching method (control group) and those who were taught utilizing differentiated activities based on the whole-brain approach (experimental group). The perceptions of ValTech's college instructors regarding their utilization of differentiated activities grounded in the whole-brain approach yielded a general weighted mean of 3.86, descriptively interpreted as "Often," with a standard deviation of 0.55. This result indicates that the weighted mean of the responses from the instructors varies and spreads out from 3.86 ± 0.55, or within a range of 3.31 to 4.41. Based on the key findings of this study, a proposed training plan on the utilization of differentiated instruction grounded in the whole-brain approach in teaching Electronics has been formulated to ensure that all educators are equipped with the necessary skills to differentiate activities in accordance with how the brain develops, addressing the needs of students to enhance their learning.

Recommendations

The researchers formulated recommendations based on the study's findings. Given that the utilization of differentiated activities grounded in the whole brain approach significantly enhances student engagement, the study strongly recommends that the institution prioritize the implementation of comprehensive and rigorous training programs for teachers. These programs should focus on developing teachers' skills in designing syllabi and creating exemplary lessons to effectively employ differentiated activities grounded in the whole brain approach. Educators are advised to consider their learners' characteristics and backgrounds to align teaching strategies with the principles of differentiated learning effectively. Additionally, it is imperative for the educational institution to support instructors with the necessary resources and instructional materials to optimize the implementation of differentiated instruction based on the whole brain approach during classroom discussions. This study may serve as a foundation for future researchers to explore alternative methods to assist teachers in enhancing student engagement and academic performance.

Ethical Standards

The study was ethically reviewed by the Bulacan State University Ethical Review Committee (BulSU-ERC Code TX7-DXL-T) and before the survey was conducted, informed consent form was provided to the participants. The privacy, anonymity, and dignity of the participants were protected and ensured following the relevant articles of the Data Privacy Act and no participants were subjected to harm in any way. Furthermore, all ideas, not just the researcher's original thoughts, were cited correctly. Thus, no plagiarism was committed.

References

Andaya, O. F. (2014). Factors that Affect Mathematics Achievement of Students of Philippine Normal University- Isabela Campus. International Refereed Research Journal, 5(4).

Aranda, M. R., & Zamora, J. (2016). Using differentiated instruction in improving the academic performance of students in the Filipino language. National University, Manila, Philippines. Retrieved from https://www.national-u.edu.ph/wp-content/uploads/2016/08/JSTAR-4 Aranda.pdf

Awofala, S. A. (2020). Effect of Brain Based Learning Strategy on Students' Achievement in Senior Secondary School Mathematics in Oyo State, Nigeria. Cypriot Journal of Education Science, 2, 91-106.

Conderman, G., & Hedin, L. (2014). Purposeful Assessment Practices for Co-Teachers. TEACHING Exceptional Children, 44(4), 18–27. https://doi.org/10.1177/004005991204400402

Dougherty, S. M. (2018). The effect of career and technical education on human capital accumulation: Causal evidence from Massachusetts. Education Finance and Policy, 13(2), 119-148.

Gregorio, M.S. (2016) "Technology and Livelihood (TLE) Instruction of Technical Vocational and Selected General Secondary Schools in Catanduanes". IJLTER Vol. 15, No.4, pp. 69-74. p-ISSN: 1694-2493, e-ISSN: 1694-2116. Published by International Journal of Learning, Teaching and Educational Research.

Gregory, G. H. & Chapman, C. (2015). Differentiated Instructional Strategies Professional Learning Guide Third Edition. United States of America: Corwin.

Hakim, L., Cahya, E., Nurlaelah, E., & Lestari, Z. (2015). The Application EQ and SQ in Learning Mathematics with Brain-Based Learning Approach to Improve Students' Mathematical Connection and Self-Efficacy in Senior High School. PEOPLE: International Journal of Social Sciences, 1(1), 542-557.

Hart, S.R., Stewart, K. & Jimerson, S.R. (2011). The Student Engagement in Schools Questionnaire (SESQ) and the Teacher Engagement Report Form-New (TERF-N): Examining the Preliminary Evidence. Contemporary School Psychology 15, 67–79. https://doi.org/10.1007/BF03340964

Malacapay, M. C. (2019). Differentiated instruction in relation to pupils' learning style. International Journal of Instruction, 12(4), 625—638.

Onyishi, C. N., & Sefotho, M. M. (2018). Teachers' perspectives on the use of differentiated instruction in inclusive classrooms: Implication for teacher education. International Journal of Higher Education, 9(6), 136—150.

Ryuhei, S. (2020). Overview of the ASEAN Enabling Master Plan 2025: Mainstreaming the Rights of Persons with Disabilities and Its Relevance Among ASEAN Member States. 現代福祉研究= THE BULLETIN OF THE FACULTY OF SOCIAL POLICY AND ADMINISTRATION: Reviewing Research and Practice for Human and Social Wellbeing: GENDAIFUKUSHI KENKYU, 20, 21-30.

Sanchez, H. (2017). The Education Revolution: How to Apply Brain Science to Improve Instruction and School Climate. Thousand Oaks, California: Corwin, a Sage Company.

Second Congressional Commission on Education (2025). Fixing the Foundations: A matter of national survival, EDCOM II-year two report. Congress of the Philippines

Sesmiarni, Z. (2015). Brain Based Teaching Model as Transformation of Learning Paradigm in Higher Education. Al-Ta lim Journal, 22(3), 266-275. https://doi.org/10.15548/jt.v22i3.141

Smith, S. Y. (2018). The effects of whole brain teaching on students' achievement, motivation, and perception. Trevecca Nazarene University.

Sontillano, R. D. (2018). Impact of whole brain teaching based instruction on academic performance of grade 8 students in Algebra: Compendium of WBT-based lesson plans. PUPIL: International Journal of Teaching, Education and Learning, 2(2), 98-114.

Sousa, D. (2016) How the Brain Learns. 3rd Edition, Corwin Press, Thousand Oaks, CA. - References - Scientific Research Publishing. Www.scirp.org. https://www.scirp.org/(S(i43dyn45teexj x455qlt3d2q))/reference/referencespapers.aspx?referenceid=2466723

The News Today, (2020). Issues in Philippine Education: In Retrospect. https://www.thenewstoday.info/2020/01/05/issues.in.philippine.education.in.retrospect.html

Tomlinson, C. A., & Tomlinson, C. A. (2017). How to differentiate instruction in academically diverse classrooms. 3rd Edition. Alexandria, Virginia, ASCD.

UN DESA. 2024. The Sustainable Development Goals Report 2024 – June 2024. New York, USA: UN DESA. © UN DESA. https://unstats.un.org/sdgs/report/2024/.

Yasin, R.M., Nur, Y. F., Ridzwan, C. R., Ashikin, H. & Bekri., R.M. (2015). "Current Trends in Technical and Vocational Education Research: A Meta-Analysis" Faculty of Education, National Malaysia University.

Zulaikha, Z. F., Hariri, H., Rini, R., & Sowiyah, S. (2021). Analysis of vocational education curriculum in ASEAN Economic Community: a literature review. Journal of Social, Humanity, and Education, 1(3), 157-170.