

Public School Science Teachers' Perceptions on the Effectiveness of Center-Based Learning Approach: A Content Knowledge-Based Method

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Abstract

Science is perceived to be of importance because of its link to technology and industry. The study investigated the perception of the elementary public school Science teachers on the effectiveness of the Center-Based Learning Approach to the learning capabilities of the pupils. The Center-Based Learning Approach encourages learners to explore and discover concepts and ideas through Multiple Learning Centers where they can actively participate namely: Computer Center, Art/Activity Center, Journal and Writing Center, Reading Center and Manipulative Center. It relies heavily on computer-aided learning modules and richly illustrated lessons. Using this approach, the lessons are made not just enjoyable and fun but also encourage learner to use his imagination and critical thinking thereby developing multiple intelligences as different learning styles and preferences are catered. This qualitative research used a descriptive normative survey design. The researcher computed the mean of the responses of teachers on their perception of CBLA based on the Productive Pedagogies Framework for Classroom Reflection criteria of the Department of Education and Technology, Queensland, Australia. The questionnaire includes observable behaviors related to the five characteristics of an effective and productive pedagogy. As assessed by the teachers, all the characteristics and behaviors of a productive pedagogy were observable in all the centers of the CBLA. The elementary public-school teachers perceived that the CBLA is an effective approach in teaching elementary Science & Health subject. It possesses the characteristics that influenced effective teaching and high learner performance. It is therefore an effective approach in teaching. It is recommended for utilization and application in teaching of Science and Health subject in the Department of Education (Deped).

Keywords: CBLA, Effective Pedagogy, Teaching Science and Health, Integrating Technology, Approaches, Science Teachers

1. Introduction

It can be challenging for educators to turn a bare classroom into a place where students can learn while also appealing to their senses. Moreover, the "Centers" offer a way to establish distinct areas for learning rather than requiring constant material distribution or giving the impression that the room is a haven for hoarders. Each center focuses on a different area of education that encourages organized hands-on learning. Science is perceived to be of importance because of its link to technology and industry. It is a high priority area for development from a national standpoint. In spite of its conceptual complexity and significant implementation costs, science is included as a foundational subject in elementary and secondary curricula. In relation, the results of the Philippine participation in the Second International Science Study (SISS, 1975) and the Third International Mathematics and Science Study (TIMSS, 1996) explicitly provided lessons for assessing and evaluating the manner of delivering science education in the country. In both of these international studies, the Philippines ranked among the lowest scoring countries. Particularly, Philippines ranked 37th out of 39 and 40th among 41 countries in mathematics and science, respectively (Lacanilao, 2011).

Accordingly, the National Achievement Test (NAT) results for Grade VI in Science were 39.49% in 2007 to 2008, 54.16% in 2008-2009, 60.3% in 2009 to 2010, 57.5% in 2010 to 2011, and 64.87%

in 2011 to 2012. These NAT statistics show that the national performance occasionally falls short of the 50% threshold. According to reports, the bad performance of sixth graders improved over the past two years, although not dramatically. The nationwide mean scores for the second year in NAT at the secondary level were 35.68% in 2006 to 2007, 36.21% in 2007 to 2008, 37.92% in 2008 to 2009, 39.37% in 2009 to 2010, and 35.91% in 2010 to 2011. These also performed at or below 50% of the national average (NAT, 2012). More so, the absence of a "science culture" is often cited as the major factor that explains students' low achievement in science. Other factors such as teacher training, the school curriculum and instructional materials, the teaching-learning process, the language of instruction, and the governance of education have also been cited as causes of the current state of science education (Ibe and Ogena, 1998).

The updated BEC (2002) states that inquiry, discovery, demonstration, practical work, laboratory, and other hands-on methods should be used to teach science. Nevertheless, the majority of scientific classes employed the "chalk and talk," "expository," and lecture approaches. Students are not actively engaged in the creation of new knowledge when using the expository method (Apat *et al.*, 2007). Because scientific processes like inferring, forecasting, and generalizing take time to acquire, teachers are more comfortable imparting facts and ideas to pupils than helping them develop and apply those processes. Additionally, this approach needs a teacher to be an expert in the field and be able to demonstrate how a novice scientist constructs meanings or uses and generates ideas (Bilbao *et al.*, 2008).

The research of Enriquez in 1996, Eferridoin in 1996, Aquino in 1996, and Erfe in 1997, to name a few, have all demonstrated that the constructivist approach to science is more efficient and fruitful than traditional approaches. According to research by Salandanan (2009) and Corpuz and Lucido (2011), new methods and approaches have also been shown to improve students' attitudes toward science. However, it has proven difficult to convince scientific teachers as a whole to adopt the ways that have been proven effective. According to Ibe and Ogena (1998), students can learn how to solve problems like those in the TIMSS with the new methods of teaching science and mathematics, but it is not anticipated that they will perform at a level comparable to that of their Asian neighbors like Singapore, Hong Kong, Korea, and Thailand until teachers change their approaches to science teaching, until competent and qualified teachers are hired, and until there is a change in the attitude toward science. Ibe and Ogena (1998) added the following: A thorough consensus may be required to decide what we want for our curriculum. Do we want a curriculum that will bring us to the middle level of performance among participating countries in the next international science and mathematics study? Or do we want a curriculum that will bring us to the top level of performance? We must continue doing analysis of the curriculum, especially on its "weak areas," coverage of lessons, and effectiveness. With regard to dealing with students' learning as well as how these resources involve various students in shaping learning experiences, new and developing educational technologies including computer software, CD-ROMs, simulation tools, and other multi-media resources are confronting teachers (Corpuz and Lucido, 2008).

Science education in the K–12 curriculum aims to foster scientific competence. It gives students the chance to engage in scientific endeavors, scientific thinking, inquiry, investigation, evidence collecting and analysis, logical reasoning, communication, and information application. To develop scientific proficiency fully, a variety of instructional strategies are required. These methods will

have an impact on how well students learn scientific principles, underlying ideas, and practical applications (Giron, 2012). The kind of instruction that pupils will require to meet the standards should be implemented by the teacher. A teacher should select pedagogical strategies that can help pupils learn and comprehend science more (ICSU, 2011). In fact, the aim of this study was to assess and evaluate an innovative approach, The Center-Based Learning Approach, for teaching Science and Health subjects in the elementary grades, specifically Grade VI. Over the past few decades, there has been an increase in research into strategies for science teaching preparation. The Center-Based Learning Approach, developed by a researcher who had access to IBM Philippines' support in the form of computer hardware and software as well as training from Asia Pacific College, encourages students to actively engage in learning at a variety of centers, including computer center, art and activity center, journal and writing center, reading center, and manipulative center. It makes extensive use of computer-assisted learning modules and lessons with lots of illustrations. This method encourages the learner to use their imagination and critical thinking, so fostering multiple intelligences as varied learning styles and preferences are catered to. The teachings are also made entertaining and fun. The CBLA illustrates how a teacher can change from serving as the exclusive source of knowledge and information to acting as a catalyst for learning (Apat, 2004).

2. Theoretical Framework of the Study

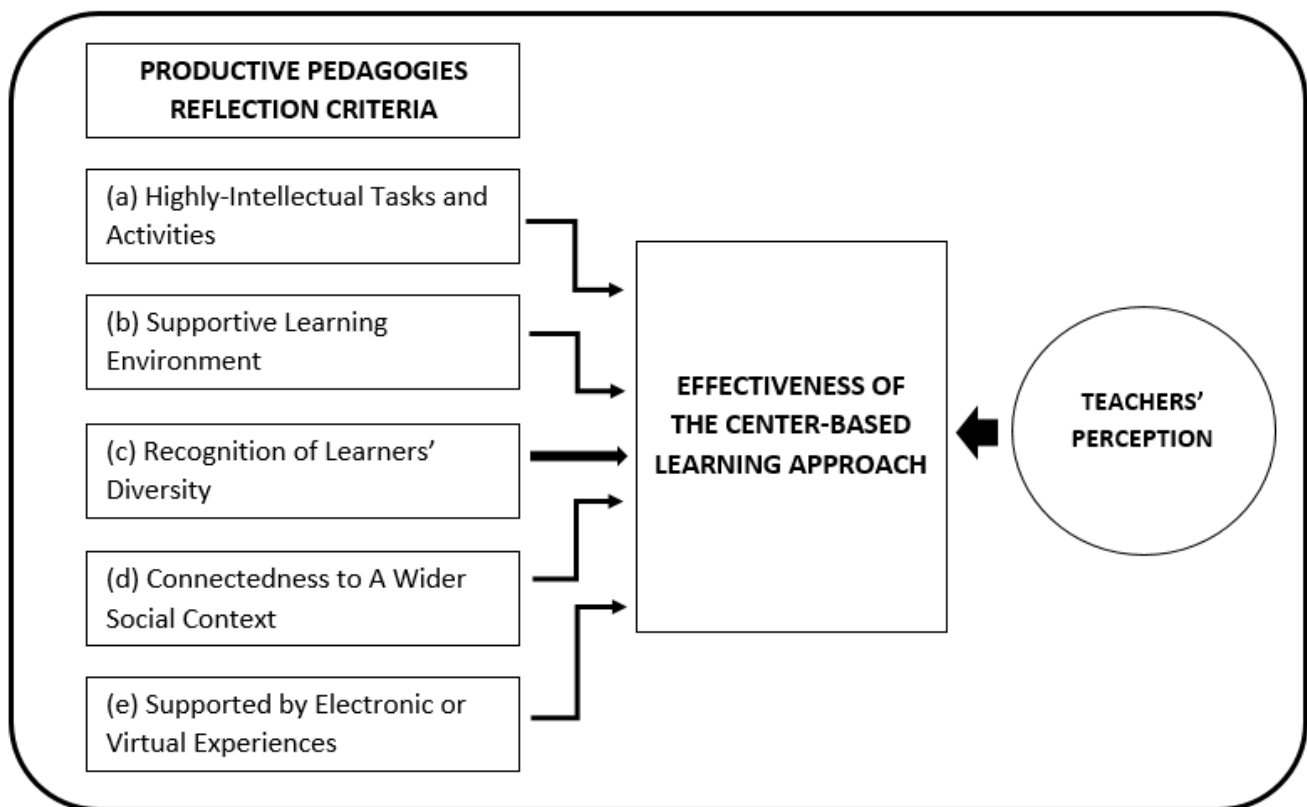


Figure 1. The Research Paradigm of the Study.

3. Objectives of the Study

The study investigates and determines the perception of the elementary public school science teachers on the effectiveness of the Center-Based Learning Approach (CBLA) on the learning

capabilities of the pupils within the Division of Agusan del Sur, based on the Productive Pedagogies Framework for Classroom Reflection Criteria of the Department of Education and Technology, Queensland, Australia. Thus, the framework includes five characteristics of an effective and productive pedagogy.

4. Methods and Materials

Research Design

A descriptive normative survey methodology was used for this qualitative study. On the basis of the Productive Pedagogies Framework for Classroom Reflection Criteria of the Department of Education and Technology, Queensland, Australia, the researcher calculated the mean of the replies from instructors regarding their perception of center-based learning approach (CBLA). The questionnaire includes observable behaviors related to the five characteristics of an effective and productive pedagogy.

The Research Locale and Respondents of the Study

The participants were the ten (10) teachers from the Department of Education (DepEd) in the Division of Agusan del Sur during the Academic Year 2012-2013 who assessed and investigated the effectiveness of the Center-Based Learning Approach in teaching based on the criteria presented in the Productive Pedagogies Framework for Classroom Reflection supplementary materials of Education Queensland, Department of Education and Technology (DET), Queensland, Australia in the year 2002 on the following criteria: a. Highly-Intellectual Tasks and Activities; b. Supportive Learning Environment; c. Recognition of Learners' Diversity; d. Connectedness to a Wider Social Context; and e. Supported by Electronic or Virtual Experiences.

Data Gathering Procedure and Statistical Treatment

The survey-questionnaires and checklist with observable behaviors related to the characteristics of an effective pedagogy (5 criteria) were answered and filled-up by the ten DepEd teachers as they observed actual demonstration teaching using the Center-Based Learning Approach (CBLA). The respondents investigated if the behaviors stipulated in the questionnaire and checklist were present or observable in the different centers of the approach, the Center-Based Learning Approach. They ticked "yes" when the behavior and characteristics were observable and "no" when the behavior was not observable in the center.

The data collection involved answering questionnaires for teachers. The researcher got the weighted mean of the responses of the teachers on their perception of CBLA. The live demonstration teaching was done by a Science and Health Grade VI teacher and Science Coordinator, Mrs. Tita U. Gavino of East Prosperidad Central Elementary School (EPCES), Prosperidad, Agusan del Sur, with 43 pupils from the Narra section. The subject matter was Volcanic Eruption, one of the learning competencies of Science and Health subjects for Grade VI level found on PELC page 17. The demonstrator used the interactive curriculum software, "Module in Science Grade VI"; print reference, "The Amazing World of Science Grade VI" pages 206-208 and "Science Quest Teacher's Guide" page 208.

5. Results and Discussions

The effectiveness of the center-based learning approach was evaluated by public school teachers based on the following criteria: highly intellectual tasks and activities; supportive learning environment; recognition of learners' diversity; connectedness to a wider social context; and support for virtual experiences in the five (5) learning centers, which are the computer center, art and activity center, journal and writing center, reading center, and manipulative center (Tables 1 to 5).

Based on the findings, table 1 shows the assessment of public-school teachers on the criteria of highly-intelligent tasks and activities in the five learning centers. The table represents the number of teachers who explicitly checked "yes," which means the behavior is observable in the particular center. More so, table 1 showed that in the Computer Center, 100% of the teachers agreed that students were doing tasks and activities that were of high intellectual quality. The fact that they were engaged with HOTS - Higher Order Thinking Skills, knowledge was made clear and made concrete. The output and responses of the students demonstrated a clear understanding of concepts or ideas. The learners were active in the construction of new knowledge. Aspects of language, grammar, and technical vocabulary were being given prominence.

Table 1. An Assessment of Teachers in a Center-Based Learning Approach in Terms of Highly-Intellectual Tasks and Activities.

Indicators	CC	A/AC	J/WC	RC	MC
(a) Students are engaging with HOTS- Higher Order Thinking Skills.	10	10	10	10	10
(b) Knowledge is made clear and made concrete.	10	10	10	10	10
(c) The output and responses of the students demonstrate a clear understanding of concepts or ideas.	10	10	10	10	10
(d) There is interaction amongst students, between teacher and students.	10	10	10	10	10
(e) The learner is active in the construction of new knowledge.	10	10	10	10	10
(f) Aspects of language, grammar and technical vocabulary are being given prominence.	10	8	10	10	9
Mean Value	10	9.7	10	10	9.8
Percentage (%)	100	97	100	100	98

Legend: CC; Computer Center, A/AC; Art/Activity Center, J/WC; Journal/Writing Center, RC; Reading Center, MC; Manipulative Center

Furthermore, in the Art/Activity Center, an average of 97% of the teachers agreed that students were doing tasks and activities that were of high intellectual quality. The aspects of language, grammar, and technical vocabulary were not given prominence, but they were engaged with HOTS - Higher Order Thinking Skills. Knowledge was made clear and made concrete. The output and responses of the students demonstrated a clear understanding of concepts or ideas. The learners were active in the construction of new knowledge. In the Journal/Writing Center, 100% of the teachers agreed that students were doing tasks and activities that were of high intellectual quality. The fact that they were engaged with HOTS - Higher Order Thinking Skills, knowledge was made clear and made concrete. The output and responses of the students demonstrated a clear

understanding of concepts or ideas. The learners were active in the construction of new knowledge. Aspects of language, grammar, and technical vocabulary were being given prominence.

In addition, and based on the results from the data gathered by the researcher, it was illustrated that in the Reading Center, 100% of the teachers agreed that students were doing tasks and activities that were of high intellectual quality. The fact that they were engaged with HOTS - Higher Order Thinking Skills, knowledge was made clear and made concrete. The output and responses of the students demonstrated a clear understanding of concepts or ideas. The learners were active in the construction of new knowledge. Aspects of language, grammar, and technical vocabulary were being given prominence. In the Manipulative Center, 98% of the teachers agreed that students were doing tasks and activities that were of high intellectual quality. The aspects of language, grammar, and technical vocabulary were not given prominence, but they were engaged with HOTS - Higher Order Thinking Skills. Knowledge was made clear and made concrete. The output and responses of the students demonstrate a clear understanding of concepts or ideas. The development of new information involved the learners actively.

Table 2 shows the assessment of public-school teachers on the physical, psychological, and social learning environments of the five learning centers of the Center-Based Learning Approach. The number of teachers who checked "yes" agreed that CBLA favors a supportive learning environment.

Table 2. Assessment of the Teachers on CBLA in terms of Supportive Learning Environment.

	Indicators	CC	A/AC	J/WC	RC	MC
(a)	There are opportunities for students to create and construct knowledge by themselves through "hands-on-minds-on" and "learning by doing" activities using all the senses.	10	10	10	10	10
(b)	The classroom characterized by an atmosphere of mutual respect and support between teacher and students, and among students.	10	10	10	10	10
(c)	Student's interest is ignited to become engaged or become motivated to the lesson. (Motivation)	10	10	10	10	10
(d)	The criteria for judging the performance of the students are made clear.	10	10	10	10	10
(e)	The tasks and activities presented, regulate student's behavior.	10	10	10	10	10
	Mean Value	10	10	10	10	10
	Percentage (%)	100	100	100	100	100

Legend: CC; Computer Center, A/AC; Art/Activity Center, J/WC; Journal/Writing Center, RC; Reading Center, MC; Manipulative Center

On the table, all the five centers (computer center, art/activity center, journal/writing center, reading center, and manipulative center) were supportive of the physical, psychological, and social learning environment of the learners. There were opportunities for students to create and

construct knowledge by themselves through "hands-on-minds-on" and "learning by doing" activities using all the senses. The classroom is characterized by an atmosphere of mutual respect and support between the teacher and students and among students. Students' interests were ignited to become engaged or become motivated in the lesson. The criteria for judging the performance of the students were made clear. The tasks and activities presented automatically regulated the students' behavior (Table 2).

The table 3 presents the assessment of public-school teachers on Recognition of Learners' Diversity. The number of teachers who checked "yes" reflected the percentage of the extent of recognition on the socio-cultural backgrounds of the students in the five learning centers of the Center-Based Learning Approach. Hence, table 3 revealed that recognition of difference was supported by 100% of the four centers: Computer Center, Art/Activity Center, Journal/Writing Center, and Manipulative Center. Students from cultural minorities or ethnic groups were valued. Students from diverse backgrounds were given opportunities to actively engage in learning. The style of teaching was experiential and based on real-life experiences. The learners are reflecting on personal experiences rather than exposure. The classroom atmosphere was democratic. All the students were enjoying their rights and doing their responsibilities. Only 96% of the teachers believed that in the Reading Center, good ideas that were originated and discovered by a student or class were given positive recognition. It is because, in the Reading Center, pupils were more exposed to authors and proponents of theories and ideas than new knowledge.

Table 3. The Assessment of the Teachers on the Center-Based Learning Approach (CBLA) in terms of Recognition of Learners' Diversity.

Indicators	CC	A/AC	J/WC	RC	MC
(a) Students who belong to cultural minority or ethnic groups are valued.	10	10	10	10	10
(b) Students from diverse background are given opportunities to actively engage in learning.	10	10	10	10	10
(c) The style of teaching is experiential and basing on the real-life experiences. Learners are reflecting personal experiences rather than exposure.	10	10	10	10	10
(d) Good ideas, originated and discovered by a student or class are given positive recognition.	10	10	10	8	10
(e) The classroom atmosphere is democratic. All students are enjoying their rights and doing their responsibilities.	10	10	10	10	10
Mean Value	10	10	10	9.6	10
Percentage (%)	100	100	100	96	100

Legend: CC; Computer Center, A/AC; Art/Activity Center, J/WC; Journal/Writing Center, RC; Reading Center, MC; Manipulative Center

Table 4 shows the assessment of public-school teachers on the five learning centers of the Center-Based Learning Approach on the issue of the connectiveness of the lesson to a wider social context. The figure represented the number of teachers who checked "yes," which means the behavior was observable in that particular center.

Table 4. Assessment of the Teachers on the Center-Based Learning Approach (CBLA) in terms of Connection to a Wider Social Context.

Indicators	CC	A/AC	J/WC	RC	MC
(a) The lesson is integrated across subject areas in the Curriculum.	10	10	10	10	10
(b) There are opportunities for students to connect prior knowledge and experiences with the new topics they are studying and acquiring.	10	10	10	10	10
(c) The lesson activity or task is connected to the competencies or concerns beyond the classroom.	10	10	10	10	10
(d) It creates an environment where there is identifying and solving real-life problems.	10	10	10	10	10
(e) The lessons are made relevant and applicable to the needs of the times.	10	10	10	10	10
Mean Value	10	10	10	10	10
Percentage (%)	100	100	100	100	100

Legend: CC; Computer Center, A/AC; Art/Activity Center, J/WC; Journal/Writing Center, RC; Reading Center, MC; Manipulative Center

The centers of the Center-Based Learning Approach had 100% capacity to make lesson connections to a wider social context of diverse learners. The lesson was integrated across subject areas in the curriculum. There were opportunities for students to connect prior knowledge and experiences with the new topics they were studying and acquiring. The lesson activity or task was connected to the competencies or concerns beyond the classroom. It created an environment where people were able to identify and solve real-life problems. The lessons were made relevant and applicable to the needs of the times (Table 4).

The table 5 depicts public-school teachers' perceptions of the availability and accessibility of electronic or virtual resources that enhanced learning. It reflected the response of the teachers to the availability and support of ICT - Information Communication Technology, Interactive Curriculum Software, and Computer-aided Lessons/Modules. The figure represented the number of teachers who checked "yes," which means the characteristic was observable in that particular center.

Table 5. Assessment of the Teachers on CBLA in terms of Support of Electronic and Virtual Experiences.

Indicators	CC	A/AC	J/WC	RC	MC
(a) There is learning interaction in virtual environments like interactive curriculum software, computer-aided lessons/modules and there is integration of ICT Information Communication Technology.	10	0	0	0	0
(b) The virtual experiences assist students in the making of lesson connections.	10	0	0	0	0
(c) The virtual experiences support to a rich learning environment.	10	0	0	0	0

(d) The virtual learning resources provide a rich learning opportunity related to the new lesson.	10	0	0	0	0
(e) The virtual experiences offer a "learning time" that is suited to the "pace" of a learner.	10	0	0	0	0
(f) The electronic lesson is educationally sound and lesson- focused.	10	0	0	0	0
Mean Value	10	0	0	0	0
Percentage (%)	100	0	0	0	0

Legend: CC; Computer Center, A/AC; Art/Activity Center, J/WC; Journal/Writing Center, RC; Reading Center, MC; Manipulative Center

There was 100% learning interaction in virtual or electronic environments, particularly in the computer center. The virtual learning resources provided a rich learning opportunity related to the new lesson and assisted students in the making of lesson connections. The virtual experiences supported a rich learning environment and offered a "learning time" that is suited to the "pace" of a learner. The electronic lesson was educationally sound and lesson-focused. In the other centers, Art/Activity, Journal/Writing Center, Reading Center, and Manipulative Center, all teachers found no electronic explorations (Table 5). According to the demonstrator, Mrs. Tita U. Gavino, and the teacher-observers of EPCES, in the center-based activities, good ideas originated and derived from the pupils; pupils were motivated; it developed higher-order-thinking skills; there was interaction between pupils and teacher; it was learning by doing instruction; the output demonstrated a clear understanding of the concept; the task and activities regulated pupils' behavior; the lesson was backed-up by ICT; the lesson developed writing skills; it was a hands-on-minds-on activity; there were opportunities for pupils to connect prior knowledge; knowledge was made clear and concrete; good ideas were given positive recognition; and the classroom atmosphere was democratic.

In addition to giving students the chance to explore, experiment, and create their own knowledge, learning centers, according to Bottini and Grossman (2005), also give kids chances to move around, socialize, make decisions, take responsibility, and solve problems. Further, according to Bottini and Grossman (2005), a classroom that incorporates art, music, and movement activities in the centers allows for the expression of thoughts and feelings, reduces tension, and promotes creativity. Children had the chance to explore, experiment, and build their own knowledge at the centers.

According to Rateliff and Barr (2013), learning center instruction helped students since it promoted independent learning, social engagement, and multi-sensory learning while fostering the development of problem-solving abilities and involving kids in the learning process. He claimed that center-based instruction provided opportunities for students to move around, make decisions, and foster personal accountability. Online courses and other computer-based education may be offered at these learning facilities. There are currently a large number of websites dedicated to early childhood education that offer interactive learning center activities in science, reading, arithmetic, and other areas. These websites are available for use in the classroom and can be suggested to parents for use at home. According to Patel's (2003) study of a teaching approach, the modern university, particularly in a multi-cultural and open society, must be able to meet the needs of a diverse student population. An effective approach leads to a stimulating learning

environment that accommodates and recognizes different kinds of students and varying ethnic groups. Philosophers such as Plato and Rousseau argued that education had to address multiple dimensions of the individual while relating the person to society.

The researcher commended and attested that in center-based learning, pupils can develop their intelligence to the utmost in the learning style they prefer best. The researcher also realized that effective use of technology requires a skillful teacher. Three important sets of interactions happened in the CBLA learning environment. The pupils will interact with the teacher at the beginning of the session as a preparatory activity. Then the pupils will explore, investigate, experiment, and experience the five center-based tasks created by the teacher. Pupils will interact with peers and group mates in discovering and constructing new knowledge in the different centers (cooperative learning or social constructivism learning). After the new learning was developed, they met again with the teacher, guiding the pupils in drawing important concepts and evaluating the pupils' learning.

Therefore, the most significant observation of the researcher is the role transformation of the teacher when using the Center-Based Learning Approach. The teacher, previously perceived to be the sole source and provider of knowledge, significantly transformed into a facilitator in the construction of new knowledge. The teacher becomes a provider of a creative and active learning environment for the learners where they process new learning on their own. It is a very significant role for a teacher, a catalyst of change and transformation.

6. Conclusion and Recommendations

The Center-Based Learning Approach has the qualities that contribute to efficient instruction and excellent student performance. The teachers thought the CBLA was a good way to teach health and science in the elementary grades. Additionally, learning center education benefited students since it encouraged self-directed learning, social interaction, and multisensory learning while supporting the growth of problem-solving skills and immersing children in the learning process.

The center-based learning approach possesses the characteristics of a productive and effective pedagogy. It is therefore recommended for utilization and application in the Department of Education (DepEd). Lastly, in deciding what approach, method, strategy, or technique to choose and use in teaching, teachers should base their decisions on using the productive pedagogy reflection criteria used by the researcher.

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Avenue for Further Research

1. The use of CBLA in secondary and tertiary education to improve students' multiple intelligences.

2. The impact and use of electronic learning resources in improving learning.
3. The facilitator role of the teacher vs. educational technology.
4. Multiculturalism and Virtual Experiences
5. A study on the effectiveness of CBLA in teaching other disciplines at the elementary level, like mathematics, English, Makabayan, and Filipino

Statement of Conflict of Interest

The author declares that there is no conflict of interest regarding the publication of this research paper.

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AUTHOR'S PROFILE



May Quilantang Apat, LPT, MAEd, PhD., Associate Professor V, holds a degree of Doctor of Philosophy in Educational Planning and Management. She was the author of the book "The Center-Based Learning Approach," which is an innovation in the teaching and learning process. More so, the approach relies heavily on computer-aided learning modules and is explicitly rich in illustrated lessons. She received an award for Best Teachers' Portfolio on Integrating Technology in Teaching from IBM Philippines; Best Oral Research Presenter at the Philippine Association of Institutions for Research; and a Loyalty Award for 30 years of service. Additionally, Dr. Apat is a regular contributor to educator's magazines.