INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY: APPLIED BUSINESS AND EDUCATION RESEARCH
2023, Vol. 4, No. 7, 2535 – 2543
http://dx.doi.org/10.11594/ijmaber.04.07.30

Research Article

Filipino-Based Learning Activity Sheets (LAS): Impacts on Grade 10 Students' Conceptual Understanding of Plate Boundaries and Earthquakes

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Article history:
Submission July 2023
Revised July 2023
Accepted July 2023

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ABSTRACT

This study aimed to examine the impacts of Filipino-based Learning Activity Sheets (LAS) on Grade 10 students' conceptual understanding of plate boundaries and earthquakes in science under the modular distance learning modality. Using a pre-experimental one-group pretest-posttest design, 30 students from Tomas V. Rivera National High School in Cawayan, Masbate were randomly selected to participate in the study. The results showed a significant improvement in students' conceptual understanding of plate boundaries and earthquakes, with a positive mean gain of 6.8 and 7.1, respectively, from the pretest to the posttest scores. Specifically, the students' level of conceptual understanding improved from 23.7% to 96.8%, with a 97% correct response rate on the posttest results. Moreover, paired sample t-test analysis revealed that the posttest scores of the students were significantly higher than their pretest scores at the 5% level of significance. These findings suggest that Filipino-based LAS significantly enhances students' conceptual understanding and mastery of concepts related to plate boundaries and earthquakes in Grade 10 Science under modular distance learning mode.

Keywords: *Contextualization, Filipino, Learning activity sheets, Modular distance learning*

Introduction

With the advent of the COVID-19 pandemic, governments have resorted to utilizing distance learning, such as online learning and modular approaches (Sarmiento et al., 2021). In the Philippines, the Department of Education has prohibited the conduct of face-to-face classroom settings to prevent virus

How to cite:
Cajurao, E. C., Cajurao, I. P., Romero, J. N., Bolivar, J. T., Diestro, J. L., & Merida, M. C. E. (2023). Filipino-Based Learning Activity Sheets (LAS): Impacts on Grade 10 Students' Conceptual Understanding of Plate Boundaries and Earthquakes. *International Journal of Multidisciplinary: Applied Business and Education Research*. *4*(7), 2535 – 2543. doi: 10.11594/ijmaber.04.07.30

transmission. Instead, the agency has implemented modular distance learning, specifically the use of modules as an alternative means to reach learners in remote areas who do not have internet access (DepEd, 2020a). The Department of Education has been firm in its stand that "Learning must continue despite the pandemic." Different learning modalities have been considered and explored, ensuring that each will be the best fit for students' needs and interests in continuous learning. Modular learning is the "backbone" of DepEd's distance learning, as enshrined in DepEd Order No. 341, Series 2020 ((DepEd, 2020b). Other modes of learning, such as online, TV, and radio broadcasts, would supplement the modules. Modular learning is the preferred mode of parents and students for distance learning since access to technology and connectivity remains a problem for most of them (Magsambol, 2020).

The modular approach refers to the application of modules, which are units of work in a course of instruction that are self-paced and self-contained methods of learning in all subject areas (Anzaldo, 2021; Sejpal, 2013). It has been demonstrated that a modular approach to instruction increases students' academic achievement (Abude, 2021; Valencia, 2020) and learner autonomy (Nardo, 2017). Language, on the other hand, is the method of human communication, either spoken or written, consisting of the use of words in a structured and conventional way. It is an integral feature of educational practice in the classroom (Walter, 2010). The harmonious interaction between teachers and learners is based on the effective communication of ideas, beliefs, emotions, and thoughts (Zhou, 2021).

In teaching science subjects, learners develop science concepts based on their linguistic competence and experience (Acuña, 2014). This is prevalent among all Filipino secondary learners who face difficulties in learning science concepts and ideas taught in the English language. Moreover, learners learn more quickly through a common language than through unfamiliar linguistic mediums (Alimi et al, 2020; Cummins et al., 2015; Sardana & Rathore, 2022). Moreover, the 1987 Philippine Constitution emphasizes, as stipulated in Section 6 of Article 14, that Filipino is the national language, and that the government shall take measures to initiate and sustain the use of Filipino as the medium of official communication and as the language of instruction in the educational system (Official Gazette, 1987). When Filipino is used as the medium of instruction, students not only learn the language but also become acquainted with the richness of Filipino culture (Bernardino, 2019).

Learners who were taught science lessons in Filipino were more at ease to participate in the recitation, and the students could easily understand what the teacher was explaining (Vela, 2015). Explaining science in Filipino will help improve classroom interaction, and schools need not attempt to translate scientific and technical terms (Lartec et al., 2014). Another study found that 66.7% of 45 Filipino grade three learners preferred Filipino for presenting and expressing their ideas during instruction and 62.2% for assessments and exams (Domingo, 2015). There have been few studies about the integration of Filipino in science subjects and the effects of it on students' performance - the gap that the researchers are interested in. This study postulates that using a modular approach, incorporating the Filipino language into science education could help students understand the material better.

Research Questions

This study aimed to evaluate the impacts of Filipino-based Learning Activity Sheets (LAS) on students' conceptual understanding of plate boundaries and earthquakes. Specifically, it seeks to answer the following questions:

1. What is the effect of the developed Filipino-based Learning Activity Sheets (LAS) on students' conceptual understanding of plate boundaries and earthquakes in Grade 10 science?
2. Is there a significant difference between the mean pretest and posttest scores of students in the achievement test?

Theoretical Review

Contextualization and Language

Contextualization refers to the process of adapting instructional materials to match the sociocultural context, experiences, and language of learners (Chen et al., 2021). It

recognizes the importance of connecting new knowledge to prior experiences and cultural backgrounds to facilitate meaningful learning. Utilizing the first language known to learners, such as Filipino in the Philippine context, provides a familiar linguistic and cultural foundation for students, enabling them to comprehend and internalize complex scientific concepts more effectively (Darling-Hammond et al., 2020).

Cognitive Load Theory

Cognitive Load Theory suggests that learning is influenced by the amount of mental effort required to process information (Castro-Alonso et al., 2019). When students encounter instructional materials in an unfamiliar language, their cognitive load increases due to the additional effort required to decode and comprehend the content. By employing Filipino-based LAS, the cognitive load can be reduced as students engage with materials that align with their linguistic abilities and cognitive processes. This reduction in cognitive load allows students to allocate more mental resources toward understanding the scientific content, leading to improved conceptual understanding (Kalyuga, 2011).

Language and Conceptual Understanding

Research has indicated that the language of instruction significantly impacts students' comprehension and conceptual development (Schleppegrell, 2018). When students are taught in their first language, they can easily grasp the meaning, value, and applications of scientific concepts. This is particularly important for complex topics such as plate boundaries and earthquakes, where a solid conceptual foundation is crucial for further scientific exploration. By using Filipino-based LAS, students can relate scientific concepts to their daily experiences and cultural contexts, enabling deeper understanding and promoting meaningful learning (Cummins et al., 2015).

Sociocultural Theory

Sociocultural Theory emphasizes the role of social interaction and cultural tools in the learning process (Vygotsky & Cole, 1978). Language, as a cultural tool, shapes students' understanding of scientific concepts. When students learn in their first language, they have access to familiar linguistic and cultural resources that support their cognitive development and conceptual understanding (Otwinowska & De Angelis, 2014). This alignment between language and culture facilitates effective communication, meaning-making, and knowledge construction. By utilizing Filipino-based LAS, students can engage in meaningful interactions with the content, drawing upon their cultural and linguistic backgrounds to construct their understanding of plate boundaries and earthquakes.

Furthermore, Sociocultural Theory highlights the importance of social interaction in learning. When students learn in their first language, they can engage in collaborative discussions and interactions with their peers, teachers, and community members, promoting a socio-constructivist learning environment (Vygotsky & Cole, 1978). Through such interactions, students can negotiate meaning, co-construct knowledge, and develop a deeper understanding of plate boundaries and earthquakes. The use of Filipino-based LAS encourages active participation and engagement, fostering a supportive learning community where students can collectively explore and make sense of scientific concepts.

Methods

Research Design

This study utilized a pre-experimental one-group pretest-posttest design. This design is a simple way to measure changes in a single group over time and can be useful in situations where it is not feasible or ethical to have a control group (Babbie, 2016). The systematic representation of the said design is shown below:

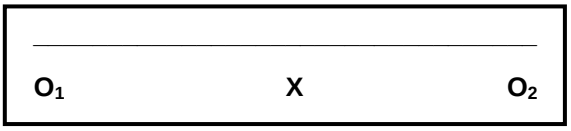

Figure 1. The research design of the study

Where:

X – Contextualized LAS
O_1 – Pretest
O_2 – Posttest

Sampling Method

Participants were recruited using simple random sampling. Thirty Grade 10 students from Tomas V. Rivera National High School were randomly selected from a bowl of all 75 S.Y. 2021-2022 students. To give each student an equal chance of being chosen (Kothari, 2004). A random sample represents the population impartially (Berndt, 2020).

Study Respondents

Thirty (30) Grade 10 students enrolled at Tomas V. Rivera National High School for the School Year 2020-2021 were randomly selected to participate in the study. The median age of the participants is 16 (age range from 14-18), 18 (60%) are females, and 12 (40%) are males.

Instrumentation

The Plate Boundaries and Earthquake Achievement Test (PBEAT) is a researcher-made achievement test aimed to measure the conceptual understanding of students on plate boundaries and earthquakes in Grade 10 Science. The test consists of 19 multiple-choice questions. 10 items for plate boundaries and 9 items for earthquakes. It was administered as a pretest and posttest before and after the try-out of the developed Learning Activity Sheets (LAS) with Filipino translations. To establish the content validity of the test, it was submitted to three science experts with master's degrees for validation. Suggestions and comments from the expert jurors were added after the content validation. The test was also subjected to reliability testing. Results from pilot testing showed that the test exhibits consistency (KR-20=0.72) which established the reliability and consistency of the instrument.

Contextualized Learning Activity Sheets (LAS) in Plate Boundaries and Earthquake

The researchers created Learning Activity Sheets (LAS) for Plate Boundaries and Earthquakes, essential lessons covered in the 3rd Quarter of S.Y. 2021-2022, using the Most Essential Learning Competencies (MELCs) in Grade 10 Science. In the 3rd and 4th quarters, Self-Learning Modules (SLMs) were temporarily replaced by LAS as science learning materials. Learning Activity Sheets (LAS) are supplementary learning materials that offer personalized learning activities to reinforce lesson content. Through the LAS's learning activities, students can expand their learning opportunities and deepen their understanding of the subject matter to meet the K–12 Basic Education Curriculum's requirements (DepEd, 2021). Learning materials were carefully developed, translated, validated, and drafted in stages. The researchers created two Modules with Filipino and English instruction. Three Filipino teachers from Grades 10, 11, and 12 validated and approved module translations using content and language validation and annotations to determine LAS Filipino terms and sentence constructions.

Data Collection Method

The school principal and Grade 10 students' parents permitted the researchers to conduct the study. For voluntary participation, informed consent forms were provided. Modules and assessment tools were distributed to the parents. The data collection process began with a pretest to assess students' prior knowledge. Then, the students were introduced to Learning Activity Sheets (LAS) translated into Filipino for two weeks, covering one topic per LAS. Posttests assessed students' conceptual understanding after the intervention.

Data Analysis

Gathered data were analyzed using descriptive statistics such as mean scores and mean percentage scores (MPS) to evaluate the effectiveness of the LAS with Filipino translations in enhancing students' conceptual understanding of plate boundaries and earthquakes. The formula for the calculation of the mean scores and performance level is shown below. The performance level was obtained using the formula for Mean Percentage Score.

Mean Score (MS):

$$\bar{x} = \frac{\sum \mathrm{x}}{\mathrm{N}}$$

Where: $\bar{x}$ – refers to the mean (average)
$\sum x$ – the summation of individual score
N – the total number of examinees

Mean Percentage Score (MPS)

$$\text{MPS} = \frac{\text{Lesson Mean Score Obtained}}{\text{Total No.of Items}} \text{ x } 100$$

The students' performance level in PBEAT was interpreted using the standard matrix as prescribed by the Department of Education National Education Testing and Research Center (DepEd, 2010; Fernandez, 2013), which is presented in the table below:

MPS	Descriptive Equivalent
96 - 100	Mastered
86 - 95	Closely Approximating Mastery
66 - 85	Moving Toward Mastery
35 - 65	Average Mastery
15-34	Low Mastery
5-14	Very Low Mastery
0-4	No Mastery

Inferential statistics such as the paired sample t-test was used to determine if there is a significant difference between the pretest and posttest scores in the achievement test. Parametric statistics assume the normality of data; hence, in the study, the researcher established that the gathered data follow a normal distribution, as revealed by the Shapiro-Wilk test ($p>0.05$).

Results and Discussion

The effectiveness of learning materials translated into a language known to learners has been reported in numerous studies (Lartec et al., 2014; Morales, 2016; Valdez, 2020; Vela, 2015). In this study, the researcher investigated the effects of a Filipino-based Learning Activity Sheet (LAS) in teaching plate boundaries and earthquakes in Grade 10 Science under the new learning modality –modular distance learning.

Table 1. Comparison of the Students' Mean Scores and Mean Percentage Scores in the Pretest and Posttest (n=30)

Lesson	No. of items	Pretest			Posttest		
		MS	MPS	Adjectival rating	MS	MPS	Adjectival rating
Plate Boundaries	10	2.60	26.0%	Low Mastery	9.70	97.0%	Mastered
Earthquakes	9	1.90	21.1%	Low Mastery	8.67	96.3%	Mastered
Total	**19**	**4.50**	**23.7%**	**Low Mastery**	**18.4**	**96.8%**	**Mastered**

MS-Mean Score; MPS-Mean Percentage Score

As shown in Table 1, it can be observed that the students' conceptual understanding of plate boundaries improved from 26.0% in the pretest, which is interpreted as low mastery, to 97.0% in the posttest, which is interpreted as a mastered level, a positive mean gain of 7.1 from the posttest. 70% (21/30) of the students obtained a perfect score on the posttest. The overall correct response rate of the students in the posttest is 97% (9.7/10*100). Similarly, students showed improvement in the conceptual understanding of earthquakes from 21.1% (low mastery) in the pretest to 96.3% in the posttest, a mean gain of 6.8 in the posttest. 73.33% of the students scored perfectly with a 90% correct response rate. These results suggest that the Filipino-based Learning Activity Sheets (LAS) were effective in enhancing students' conceptual understanding of plate boundaries and earthquakes in Grade 10 science. This supports the findings of Vela (2015) that students develop a better understanding of science concepts if they are taught in Filipino, a language known and understood by the students.

Table 2. Paired sample t-test results comparing the students' mean pretest and posttest scores in plate boundaries and earthquake

Lesson	Test	n	Mean	St. Dev	Mean Difference	t-cal	t-crit	df	Effect size
Plate Boundaries	Pretest	30	2.6	0.67	-7.1	-46.03*	2.05	29	0.993
	Posttest	30	9.7	0.47					
Earth-quakes	Pretest	30	1.9	0.96	-6.8	-31.03*	2.05	29	0.985
	Posttest	30	8.7	0.61					

**Significant at p<0.05*

Table 3. Independent sample t-test results comparing the male and female students' mean posttest scores in PBEAT

Test	Gender	n	Mean	St. Dev	Mean Difference	t-cal	t-crit	df
Posttest	Female	18	18.6	0.51	-0.31	1.22*	2.05	28
	Male	12	18.3	0.87				

**Not significant*

The paired-sample t-test results presented in Table 2 indicate a significant difference between the mean pretest and posttest scores in plate boundaries and earthquake in the PBEAT. The mean posttest score for the test on plate boundaries (M=9.7, SD=0.47) was significantly higher than their mean pretest score (M=2.6, SD=0.67) with a t-value of -46.03 ($p<0.05$), indicating a large effect size (d=0.993). Similarly, the mean posttest score for the earthquake test (M=8.7, SD=0.61) was statistically significantly higher (t_{29}=-31.03, $p<0.05$) than their mean pretest score (M=1.9, SD=0.96), with a large effect size (d=0.983).

These results suggest that the students' conceptual understanding of plate boundaries and earthquakes significantly improved when they were exposed to Filipino-based Learning Activity Sheets (LAS) as instructional interventions. The large effect sizes indicate a substantial impact of the LAS on students' learning outcomes in both plate boundaries and earthquake concepts. This further supports the findings of previous studies that when science concepts are introduced to learners in the Filipino language, they can easily grasp the meaning, value, and applications of concepts and have a better understanding of what the teacher is trying to convey (Vela, 2015; Valdez, 2020).

On the other hand, the independent-sample t-test revealed no significant difference between the male and female mean posttest scores in the achievement test, as shown in Table 3. This indicates that the developed interventions are effective regardless of gender.

Conclusion and Recommendations

The findings of this study provide strong evidence that the use of Filipino-based Learning Activity Sheets (LAS) is an effective instructional intervention in enhancing students' conceptual understanding of plate boundaries and earthquakes in Grade 10 Science under the new learning modality - modular distance learning. The students showed a significant improvement in their posttest scores compared to their pretest scores, as well as a significant difference in their mean scores, indicating a large effect size. These results support the findings of previous studies that using the language known and understood by the learners in teaching science concepts can lead to a better understanding of the subject matter. The results of this study can inform science teachers and curriculum developers in the development of effective instructional materials that cater to the needs of learners, especially in this time of pandemic where distance learning has become the new norm. Finally, the study found no significant difference between male and female

students' posttest scores, suggesting that the use of Filipino-based LAS is an effective strategy regardless of gender. Future research can explore the effectiveness of Filipino-based LAS in other subject areas and grade levels, as well as investigate other factors that may affect students' learning outcomes in modular distance learning.

Acknowledgement

The researchers are grateful to the school administrator and Grade 10 teachers at Tomas V. Rivera National High School in Cawayan, Masbate, for their assistance in making this research possible.

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