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Contextualized learning module: Enhancing students' conceptual understanding in physics

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Abstract

The research investigated the effect of contextualized learning module in enhancing the conceptual understanding in Physics among Grade 9 students in a major high school in Region XII of the Philippines. Employing a descriptive and experimental design, the study compared two modules: one aligned with the DepEd curriculum and the other contextualized to students' real-world experiences. The independent variable was the type of module used, with the control group utilizing the DepEd module and the experimental group employing the contextualized learning module. The dependent variable was the gain score measured through pretest and posttest. Each module consisted of 15-item multiple-choice and 5-item open-ended questions that underwent content validation.

The results revealed that the experimental group had an average posttest score rank that was considerably higher ($p < 0.01$) than the control group. Furthermore, the higher posttest results of the experimental group demonstrate the advantages of contextualized learning in physics instruction, particularly in terms of simplifying lesson-related learning tasks in comparison to the control group. Results in the gain scores yielded a statistically significant result ($p < 0.01$), indicating a substantial difference in learning outcomes between the control and experimental group. This suggests that using contextualized learning modules to enhance students' learning outcomes is beneficial.

Introduction

Contextualization in education is "the educational process of relating the curriculum to a particular setting, situation or area of application to make the competencies relevant, meaningful and useful to all learners" (DepEd Order No. 32 s. 2015). It can be applied by connecting what is taught to real-world situations, experiencing new knowledge through hands-on activities, applying ideas to real-world scenarios, solving problems by communicating with each other, and transferring knowledge in a new context.

Former DepEd Undersecretary of the Philippines Dina Ocampo stated that the curriculum must be localized and contextualized to make it relevant to the learners (Ocampo & Buenviaje, 2021). She highlighted the need to adapt materials, instruments, and strategies based on the students' characteristics and the local context to ensure that the curriculum is delivered effectively.

In response to the pandemic, schools had to adapt quickly to remote learning, resulting in the distribution of learning modules aligned with essential Science competencies, including Physics. These modules are meticulously organized documents designed to support self-guided and self-paced learning. They usually comprise learning goals, an introduction, instructional material, guidelines, learning activities, and test questions with feedback.

Research in the field of education has demonstrated that contextualized learning modules enhance students' engagement and understanding of subject matter. These modules connect lessons to real-life situations, using visual cues and relevant illustrations to make learning more effective and enjoyable. For example, the study of Dewi et al. (2019) found that the use of contextual

learning modules significantly enhanced the understanding of physics concepts. These modules focused on the process of generating knowledge and encourage independent learning and critical thinking.

Marzan (2018) evaluated how contextualized learning modules affected students' performance in physics. The results indicated that students who received modular instruction outperformed those in traditional lecture-based groups. Similarly, Uslima et al. (2018) indicated that contextualized learning modules, especially those with multiple representations, had a substantial impact on improving students' performance.

Thus, in accordance with Philippine Republic Act No. 10533, the study highlights the value of contextualization in instruction and is in accordance with the K-12 Basic Education Program. Despite the emphasis on contextualization and inclusion of learning modules, there are limited data on how these modules have yielded the desired outcomes in terms of student performance.

Results from national assessments show that learners find it challenging to grasp the concepts presented in the modules, which results in low scores on their summative tests. The Mean Percentage Score (MPS) in physics exams remained below mastery level from 2020-2022, raising concerns among educators at a major high school in Region XII, Philippines. Efforts to remedy this situation included remedial strategies and differentiated activities based on the most essential learning competencies (MELCs). Despite the interventions, the expected improvements were not achieved, as indicated by the School Monitoring, Evaluation, and Plan Adjustment (SMEPA) of the school division.

The concept of contextualization is proposed as a solution to address the low performance of students at a major high school in Region XII of the Philippines. Given the consensus on the effectiveness of contextualization in learning, two possibilities emerge: either DepEd modules are not yet contextualized, making it difficult for students to relate to the contents; or the modules from DepEd are already sufficiently contextualized and further contextualization is no longer needed, in which case the problem lies with other areas of instruction. This is the primary area of investigation in this research.

To further warrant the current study, none of the research focused solely on the effects of contextualization in modules. Almost all research involved adding contextualized modules as intervention. Such an approach makes it challenging to ascertain whether the improvements in performance were due to the contextualization itself or if it came merely because a module was added to the curriculum.

The objective of this study was to determine the effect of contextualized learning module in enhancing the conceptual understanding of Grade 9 students in Physics. Specifically, this study aimed to determine if there is a significant difference between the pretest scores of the students in the experimental and control groups; determine if there is a significant difference between the posttest scores of the students in the experimental and control group; and determine if there is significant difference between the gain scores of the experimental and control group.

Methodology

This study used quasi-experimental and descriptive design. The use of either the DepEd learning module or a developed contextualized learning module was the independent variable, while the students' pre-test, post-test and gain scores were the dependent variable. The phases in this study involved planning, development and validation.

During the planning stage, there was a thorough review of the current science curriculum, focusing heavily on contextualization and the development of instructional materials. This included a review of the learning competencies, performance and content standards, and suggested learning materials of the junior high school physics. The relevant materials and processes for contextualization were subsequently identified and employed as the primary inputs in crafting the contextualized modules.

In the developmental stage, a contextualized learning module was created for the topics of Conservation of Linear Momentum and Conservation of Mechanical Energy. This module was a modification of the standard learning module form DepEd.

In the validation phase, the contextualized learning module as well as the pretest and posttest were validated. Following this, a quasi-experimental design was implemented for the field-testing phase. Two groups were assigned at random to be the experimental and control groups, respectively. Both groups underwent a pretest as part of the process. Only the experimental group received the intervention (a contextualized learning module). The control group received the conventional treatment (DepEd learning module). Next, both groups completed the posttest.

There were 14 sections for Grade 9 in a major high school in Region XII of the Philippines. Using the cluster sampling method, the researcher selected two comparable sections as the study samples. One section, consisting of 50 students, was designated as the control group, while another section, also with 50 students, served as the experimental group. All students in the selected sections were included in the study through complete enumeration, and their participation was entirely voluntary.

The research instrument used to determine the effects of the treatments were teacher-made pretest and posttest questions. They were grounded on the Most Essential Learning Competencies (MELCs) for Grade 9 Science and were utilized to assess the students' conceptual understanding of the selected physics topic. The test questions were verified using a 9-item rating scale which were filled out by the subject experts, all of whom are master's degree holders in Physics and experienced in teaching physics. The test questions had a high degree of validity, as indicated by the Aiken's V coefficient, which varied from 0.85 to 0.9. Also, the Cronbach's alpha result of 0.961, with a 95% confidence interval ranging from 0.811 to 0.995, indicating excellent internal consistency reliability, and suggesting that the test questions were highly consistent in measuring the same construct and that the test is reliable tool for assessing the intended knowledge. After then, the test was given as a pretest and a posttest.

There were two modes of assessment conducted in Grade 9 in Physics. First was the conduct of 15-item multiple choice and 5-item open-ended questions with corresponding rubric for scoring in pretest. Second was the conduct of posttest in Physics. After completing the pretest, students received the contextualized learning module for independent study.

The selection of topics was based on the Mean Percentage Score (MPS) results, identifying areas with the least learned competencies as the foundation of choosing the topics. The modules are then contextualized in three ways: (1) images and illustrations, (2) learning activities and (3) terminology. Images showcasing the student's home location, municipality, scenes, landmarks, or events in the local community were incorporated in the modules. For example, Figure 1 shows a tricycle collision from the municipality, which was a contextualized version of the diagram appearing in the original DepEd module.

Figure 1. The contextualized learning module featuring a real tricycle collision event from the local community.

Changes were also made in the learning activities in the module by incorporating traditional games commonly played in a local community. For example, Figure 2 uses a local game *Tumbang Preso*, instead of a Word Hunt game presented in the original DepEd learning module.

Figure 2. The contextualized learning module integrating the traditional game

ACTIVITY 2

"TUMBANG PRESO"
Maguindanaon: TATONG

I. OBJECTIVE:

Explain how conservation momentum works in playing "*tumbang preso*"

Note: You can play it at home with siblings or friends or at school with classmates.

II. MATERIALS NEEDED:

- slipper or "tsinelas"
  Maguindanaon term: Sinilas
- can
  Maguindanaon term: Tatong

III. PROCEDURE:

Setup the experiment as shown in Figure 2 below.

Figure 5. Students of Kabacan National High School played Tumbang Preso

Tumbang Preso.

The terminologies in the modules were also modified by translating some English terms to Maguindanaon, the language mostly used by the students in a major high school in Region XII of the Philippines (Figure 3). When appropriate, names were also modified to include names of individuals from the same school.

LET'S KNOW THE CONCEPT AND FORMULA TOGETHER

MOMENTUM BEFORE AND AFTER COLLISION

(Maguindanaon term:*Bago nakadsangkuab endu ulian nu kinadsangkuab)*

Newton's third law of motion states that if an object exerts a force on the other, the other object also exerts force towards it with equal magnitude (*su kaped a kasangkapan a makapangadem bun sa bagel a pawing sa pagidsan a bagel).*

Suppose two tricycle with different masses collide (*bidaya a ugat a nakadsangkuab*) with each other. During collision (*nakandumpakay*), the two tricycle gained the same momentum but moved in opposite direction. Since the tricycles have different masses (*ugat*), they will accelerate differently as stated in Newton's second law of motion.

Figure 3. The contextualized learning module providing translations from English to Maguindanaon.

The contextualized learning module was then subjected to content validation. A rating scale adopted from DepEd (Order 001, s. 2021) was filled out by five subject experts. The assessment

utilized a rating scale to gauge validity across various criteria, including content, text, illustrations, design and layout, paper and binding quality, size and weight, presentation and organization, as well as accuracy and currency of information. The contextualized learning module's Aiken's V coefficient measured from 0.73 to 1.0, showing a high degree of validity for the module. Also, the Cronbach's alpha result of 0.969, with a 95% confidence of interval of 0.825 to 0.997, indicates that the contextualized learning module has excellent internal consistency of reliability, ensuring that the module's items consistently measure the intended educational outcomes.

The teacher's role in the control as well as the experimental groups was limited to distributing the module. No lecture was done to complement the contents of the module. The modules were studied independently by the learners. After 2 weeks, the posttest was given to the respondents. After giving the posttest, all data were gathered and consolidated by the researcher for statistical treatment.

A frequency table was created by organizing all the collected data. The Shapiro-Wilk test was used to examine the normality of the pretest and posttest data as well as the gain scores for the control and experimental groups. The Mann-Whitney U test for unpaired non-normal data sets, and the independent t-test for unpaired normal data sets were used to determine the significance of the differences across the data sets.

Results

Table 1 shows the average pretest scores of 100 Grade 9 students from major high school in Region XII of the Philippines, with 50 students in the control group and 50 students in the experimental group. Table 1 shows results of the Mann-Whitney U test, a non-parametric test since the Shapiro-Wilk test revealed that the distribution of the pretest scores of the control and experimental group were not normal ($p < .001$, $p = .009$, respectively, both $< .05$).

Table 1. Comparison between the pretest scores of the control and experimental group.

Variables (pretest)	N	Mean	Mean rank	Mann-Whitney u	p - value
Control	50	19.46	49.641	1294.50	.76
Experimental	50	20.14	51.39		

The results revealed that the pretest scores of the control and experimental group were comparable ($U = 1294.50$, $p =. 76$), suggesting that both groups' performance levels were comparable before the treatments were applied. This further means that no group has an advantage over the other.

Table 2 shows the results of Mann-Whitney U test, a non-parametric test since the Shapiro-Wilk test revealed that the distribution of the posttest scores of the control group was not normal ($p = .004 < .05$).

Table 2. Comparison between the posttest scores of the control and experimental group.

Variables (pretest)	N	Mean	Mean rank	Mann-Whitney u	p - value
Control	50	27.36	29.84	2283.00	<.001
Experimental	50	45.58	71.16		

The Mann-Whitney U test revealed that posttest scores in the experimental group ($M = 45.58$), were statistically higher ($U = 2283.00$, $p < .001$) compared to those of the control group ($M = 27.36$). Additionally, when compared to the control group, the rise in posttest scores shows the beneficial effects of utilizing the contextualized learning module in physics instruction, particularly in terms of streamlining lesson-related learning activities.

Table 3 displays the gain score of the Control group which (DepEd learning module) and the experimental group (contextualized learning module). In the test of normality using Shapiro-Wilk test, it revealed that the gain scores of the experimental group ($p = .358$, $> .05$) and the control group is ($p = .144$, $> .05$) were normally distributed. Therefore, a t-test for independent samples was

utilized to determine if there was a significant difference between the gain scores of the control and experimental group.

Table 3. Comparison of the gain scores of the control and experimental group.

Variables (Gain score)	N	Mean	Mean difference	T-value	df	p-value
Control	50	7.72	17.72	11.72**	94.69	<.001
Experimental	50	25.44				

**Significant at 1% level

With a t-value of 11.72 and $p < 0.001$ in the independent t-test, the total gain scores of the experimental group ($M = 25.44$) were found to be substantially greater than those of the control group ($M = 7.72$). This suggests that, in comparison to using the DepEd standard learning module, adopting the contextualized learning module effectively enhanced students' conceptual understanding in Physics.

Contextualized learning encourages active engagement and critical thinking, as students are challenged to connect theoretical knowledge with observable phenomena. As mentioned earlier, modifications included images and illustrations, localized activities, and language and terminologies. These images may have served to provide visual context and familiarity to the modules, making it more relatable and engaging for learners familiar with the area. Second, traditional local games related to the topics were incorporated into the module as learning activities. By featuring these activities, the modules become more interactive and culturally relevant, fostering a deeper connection with learners who are familiar with these games from their own experiences. Lastly, by offering translations, the modules became more accessible to learners who may have a stronger command of Maguindanaon than English, thereby ensuring inclusivity and comprehension. Also, this change entails incorporating names or individuals or examples from the major high school in Region XII of the Philippines into the module. By doing so, the module demonstrated personal touch and relevance to the learners.

As a result, students were likely to exhibit higher learning gains compared to traditional instruction methods, leading to improved academic performance and a greater enthusiasm for learning physics (Selvianiresa & Prabawanto, 2017). This indicates an increase in the average conceptual understanding of students who utilized the contextualized learning module compared to those who used the conventional learning module. As a result, using the contextualized learning module in the classroom resulted in benefits that improved students' conceptual understanding.

Conclusions and Recommendations

This study demonstrated that a contextualized learning module significantly enhanced students' conceptual understanding of Physics by connecting theoretical concepts to real-world applications. The notable improvement in posttest scores suggests that such an approach fosters deeper comprehension, engagement, and motivation for learning compared to the standard DepEd module. By making lessons more relevant to students' everyday experiences, contextualized learning helps bridge the gap between abstract concepts and practical applications, leading to improved retention and academic performance. These findings highlight the importance of designing instructional materials that cater to students' diverse learning needs while promoting meaningful and interactive learning experiences.

Further research should explore its effectiveness across different grade levels and subjects, incorporating qualitative methods like interviews and classroom observations for deeper insights. Investigating the role of teacher training and integrating technology, such as virtual labs and digital tools, could further optimize learning. Finally, DepEd may consider improving existing modules to align with contextualized learning, ensuring materials remain practical and impactful.

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Disclosure Statement

No potential conflict of interest was declared by the authors.

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