

## CONTEXTUALIZED MODULE USING CHURCH ARCHITECTURAL DESIGNS IN TEACHING GEOMETRY CONCEPTS

**Alabado, S.D.\*, Garilao, M.D.A.A., Nillos, A.C.G.**

Iloilo Science and Technology University Miagao Campus

\*Corresponding author: staciealabado13@gmail.com

### *Abstract*

Geometry is often considered a challenging topic in mathematics. Contextualized learning modules bridges learning gaps independently as they supplement and complement the teacher's verbal explanations in creating a learning experience. This study aimed to determine the effectiveness of contextualized module using church architectural designs in teaching geometry concepts among 32 Bachelor of Elementary Education (BEED) second year students of Iloilo Science and Technology University Miagao Campus for the Academic year 2023-2024. An adopted questionnaire with 30 items was used to assess the level of student's performance. This study used a pre-test and post-test design. Paired t-test was conducted to determine statistically significant difference between the means of both groups on their pre-test and post-test and independent samples t-test for the significant difference between the means of both groups on their post-test. The study finds out that the control and experimental groups' pre-test results are "average." In the post-test, the control group and the experimental group are considered "high." The statistical analysis reveals that the difference between the pre-test and post-test scores in the control and experimental group before and after the intervention is statistically significant. The result of this study further reveals that there is a significant difference in the post-test of both groups. The contextualized module using church architectural designs in teaching geometry concepts is an effective tool to improve student's performance and learning outcomes. Future researchers should do further studies on the contextualized module to improve students' learning outcomes in the different fields of study.

**Keywords:** Church architectural designs, Contextualized module, Geometry concepts, Student performance

## INTRODUCTION

Mathematics and architecture have always enjoyed a close association with each other, not only in the sense that the latter is informed by the former, but also in that both share the search for order and beauty. It is also employed as visual ordering element or as a means to achieve harmony with the universe. Here geometry becomes the guiding principle (Nirmal, 2013). Geometry, however, can be difficult for students to grasp because it incorporates abstract concepts and requires visualization abilities. As a result, fresh and engaging pedagogical techniques for teaching geometry are required. By introducing these into geometry instruction, students may see the significance of mathematical principles in their everyday lives.

The process of matching the content and instructional strategies relevant to students is called contextualization (Department of education [DepEd], 2016). It is the use of relevant and meaningful things, situations, and experiences to students in the presentation and discussion of the learning content. Contextualization can help enable the transformation and construction of a larger motivational environment for students (Haris & Putri, 2011). When mathematics is real and accessible, students overcome their fear which leads to an appreciation of its utility (Wang, Sun, &

Wickersham, 2017). Realistic mathematical approaches increase the learning independence of students (Hasibuan *et al.*, 2019).

Learning module offers new approaches and learning opportunities that enhance student's knowledge and helps them overcome deficiencies (Gordon and Nicholas, 2013). Learning modules develop mathematical skills (Setyani *et al.*, 2020), and improve students' abilities and affect their learning motivation (Saifiyah *et al.*, 2017). Nevertheless, contextualized learning modules are effective to bridge learning gaps independently as they supplement and complement the teacher's verbal explanations in making a learning experience. The integration of contextualization in the learning modules allows greater transfer of mathematics ideas related to their environment (Boaler, 1993; Anwar, Budayasa, Amin, & Haan, 2012).

In addition, students found geometry as a barrier to their achievement. They find it difficult to learn compared to other subjects (Rendiza & Andrada, 2009). Moreover, the teacher that handled the geometry topics at Iloilo Science and Technology Miagao Campus under the course subject EED 106 (Teaching Mathematics in the Intermediate Grades) in the Bachelor of Elementary Education (BEED) students had observed and found that most of the students had difficulties in the said subject. As a result, there is an urgent need to investigate creative teaching methodologies capable of bridging this gap and improving geometry education in college students. In view of these, the researcher advances the development of geometry module by integrating the contextualized learning approach specifically using church architectural designs through linking the teaching of contents of the said subject to their experiences to equip the BEED students of Iloilo Science and Technology University Miagao Campus with necessary knowledge intended as future educators. At the same time, the module aimed to address their difficulties in learning geometry and consequently manage the issues that may arise in teaching this subject.

### **Statement of the Problem**

Specifically, this study sought answers to the following questions:

1. What is the control and experimental groups level of performance on geometry concepts prior to the intervention?
2. What is the control and experimental groups level of performance on geometry concepts after the intervention?
3. Is there a significant difference between the control and experimental groups performance on geometry concepts before and after the intervention?
4. Is there a significant difference between the control and experimental groups performance on geometry concepts during their post-test?

### **Hypothesis**

1. There is no significant difference between the control and experimental groups' performance on geometry concepts before and after the intervention.
2. There is no significant difference between the control and experimental groups' performance on geometry concepts during their post-test.

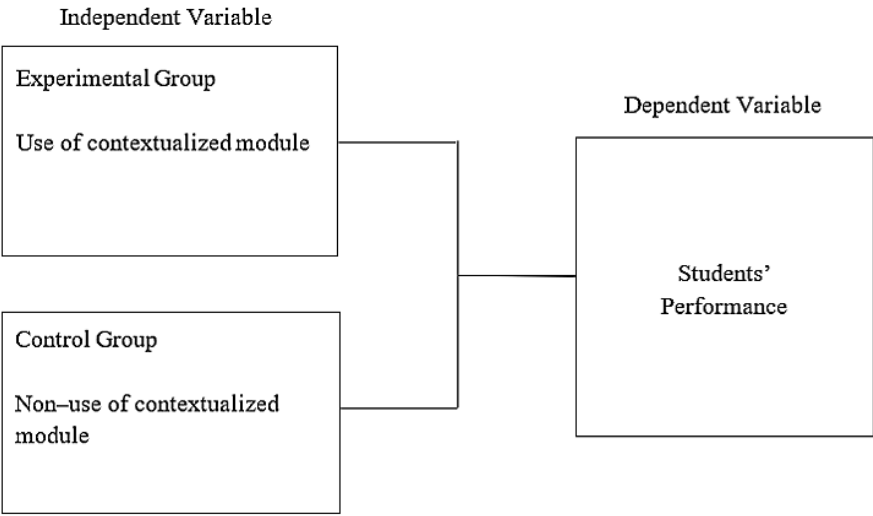


Figure 1. Conceptual framework

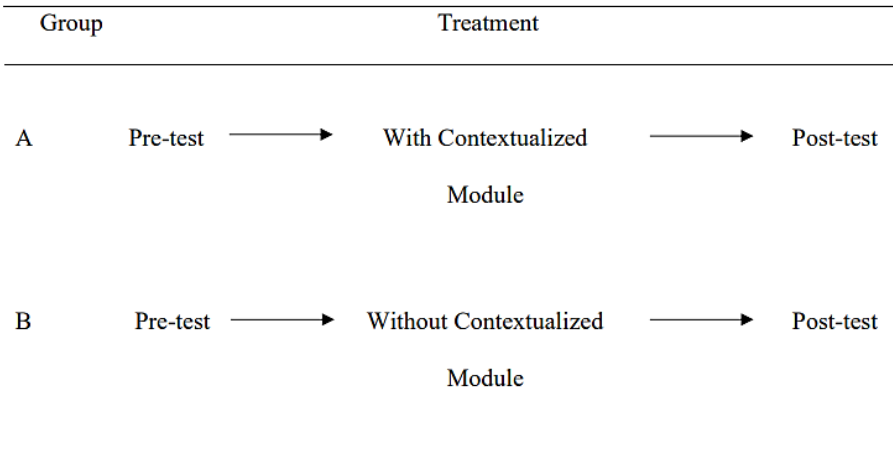


Figure 2. Quasi experimental research paradigm

LITERATURE REVIEW

According to Fischbein's theory of figural conceptions, a geometric figure always consists both a visual representation and a concept. A geometric figure, according to Fischbein (1993), Marriotti (1995) and Miragliotta and Baccaglini-Frank (2017), therefore represent mental constructs which concurrently involve both conceptual and figural properties. According to Fischbein (1993), figural concepts reflect spatial properties such as shape, position and quantity/magnitude and at the same time possess conceptual qualities such as ideality, abstractness, generality and perfection. According to Miragliotta and Baccaglini-Frank (2017), generating and processing mental images take place within the process of acquisition and use of visual-spatial abilities. Spatial reasoning involves four classes of image processing, namely generating an image, inspecting an image to answer questions about it, transforming and operating on an image and maintaining an image in the service of other mental operations, which are all aspects that propel the development of figural concepts (Miragliotta and Baccaglini, 2017). Based on this theory, this study explores the impact of spatial skills in solving coordinate geometry tasks.

### **Contextualization as Enrichment in Mathematics**

Despite of different ideas on contextualization, math teachers believed that it is more on using the student's life contexts with the help of local materials or information to deliver the new lesson in effective and efficient way. It is an integral part of the lesson which comes at the beginning of the lesson to activate the interest of the students towards the topic. Careful planning was needed to determine the appropriate materials/information to be used suited to the understanding of the students and match with the kind of topic to be discussed. It is more on knowing the lives of the learners and using those life contexts in delivering the new lesson by connecting the prior knowledge with the new one. Students developed better understanding of math concepts if these are related to their lives (Reyes *et al.*, 2019).

Math teachers experienced different challenges on utilizing contextualization, but those challenges do not hinder their willingness to deliver the lesson relevant to the needs of their students. They find different ways to deliver the lesson effectively and meaningful to the lives of their students through contextualization. Better understanding of math concepts yielded better learning as observed in students' active participation in class, outputs and examination (Reyes *et al.*, 2019).

### **Module for Learning**

As instructional material, module possesses the qualities to encourage independent learning on the individual, by progressing at his own rate. At the same time, modules have sufficient latitude to meet individual needs, and to give a feeling of achievement, no matter how little, until finally full self-realization is attained. Donnelly and Fitzmaurice (2005) suggests a framework that provides an overview of the process in module design and development, highlighting the important variables in module design and illustrating the relationships between them; however, it is important to stress that it is not a linear process.

### **The Role of Representations in Geometry**

National Council of Teachers of Mathematics (NCTM) (2000) recommends providing students opportunities to select, apply, and transfer among mathematical representations to solve problems. NCTM (2014) describes that one facet of effective teaching is to engage students in making connections among mathematical representations to deepen their mathematical understanding. All students arrive to class with prior formal and informal mathematical experiences, and using multiple mathematical representations allows students to draw on multiple sources of knowledge (Boston *et al.*, 2017). By selecting tasks which allow for students to use multiple mathematical representations, teachers can value and encourage students to draw on their mathematical, social and cultural competence, thereby positioning students as being mathematically competent (Boston *et al.*, 2017; Smith *et al.*, 2017). Giving students such opportunities to engage in tasks that allow the use of multiple mathematical representations empowers teachers to create more equitable tasks as they afford a wider range of access to mathematical ideas (Boston *et al.*, 2017).

## **RESEARCH METHOD**

The participants of this study were the Bachelor of Elementary Education (BEED) second year students of Iloilo Science and Technology University Miagao Campus for the academic year 2023-2024. They were composed of 32 students. They were divided into two groups, control group and experimental group. The selection of participants for each group were based on the match-

pairing results of their pre-test scores. Sixteen (16) participants were identified for each group. The first group was named as Group A which belongs to the experimental group and the second group was named Group B which belongs to the control group. The researchers taught the participants in the experimental group, Group A, about the lessons on geometry concepts and employed the contextualized module using church architectural designs as a strategy. The researchers also gave activities that is about geometry concepts based on the contextualized module. On the other hand, the control group was taught using the chalk talk way of teaching.

The data-gathering instrument used in this study was the 30 items adopted questionnaire to assess the level of student's performance. This study used a pre-test and post-test design. The test contained the topic of point, line, and plane, convex and concave polygons, quadrilaterals, and parallel and perpendicular lines.

To describe the effectiveness of contextualized module as a teaching and learning methodology, the researchers calculated the means and standard deviation. Paired t-test was also conducted to determine the significant difference in the mathematics performance in geometry concepts of the control group and experimental group before and after the intervention based on their pre-test and post-test results and independent samples t-test for the significant difference in the mathematics performance in geometry concepts of the experimental group after exposure to approach with the contextualized module and the control group after the approach without the contextualized module. Post-test scores of the participants with contextualized module approach and without the approach were utilized to determine the significant difference between their levels of performance.

## RESULTS AND DISCUSSIONS

The participants were the Bachelor of Elementary Education second year students of Iloilo Science and Technology University Miagao Campus. The group were composed of 32 students who were given the same pre-test and post-test before and after the intervention to compare their test scores.

Table 1. Level of performance on geometry concepts prior to the intervention

| Group        | <i>M (SD)</i> | Description |
|--------------|---------------|-------------|
| Control      | 15.19(3.94)   | Average     |
| Experimental | 15.69(4.24)   | Average     |

Table 1 shows the level of performance on geometry concepts based on the results of the pre-test scores prior to the intervention of the control group and the experimental group. The result shows that the pre-test scores of the control group are considered "average" ( $M = 15.19$ ,  $SD = 3.936$ ), while the experimental group are also considered "average" ( $M = 15.69$ ,  $SD = 4.238$ ). This indicates that the level of performance of the participants in both groups during the pre-test is all average which means that they have the same level of knowledge during the pre-test.

This result is supported by the study of Berry (2008), which states that pre-tests were administered at the beginning of a course to establish a subject knowledge baseline and the depth of knowledge that students already possess for a particular topic. It also served as a motivational tool and a 'road map' for the students, resulting in improved course performance. In addition, the

study by Taufik et al (2019), revealed that pre-tests increase the value of intelligence and understanding of the course or field of study.

Table 2. Level of performance on geometry concepts after the intervention

| Group        | <i>M (SD)</i> | Description |
|--------------|---------------|-------------|
| Control      | 18.38(3.50)   | High        |
| Experimental | 21.50(3.58)   | High        |

Table 2 shows the level of performance on geometry concepts based on the results of the post-test scores after the intervention of the control group and the experimental group. The result shows that the post-test scores of the learners without contextualized module or the control group are considered “high” ( $M = 18.38$ ,  $SD = 3.500$ ). The learners with contextualized module or the experimental group are also considered “high” ( $M = 21.50$ ,  $SD = 3.578$ ). Both the control group and the experimental group improve their scores greatly from pre-test to post-test. Although both groups have the same level of performance, the experimental group have a mean score higher than the control group, showing that the contextualized module is an effective tool in teaching geometry concepts.

The result conforms with the study by Reyes et al. (2019), where it reveals that contextualization was very useful in teaching mathematics particularly in geometry. It was one way to go away with the traditional model of instruction which was very typical in teaching math. The participants concretized concepts in mathematics and the presence of math in the environment that everything in the surroundings have patterns that can be explained by mathematics.

Table 3. Difference between the control and experimental groups' performance on geometry concepts before and after the intervention

| Group Type         | <i>M</i> | <i>df</i> | <i>t</i> | <i>p-value</i> | Description |
|--------------------|----------|-----------|----------|----------------|-------------|
| Control Group      |          |           |          |                |             |
| Pre-test           | 15.19    | 15        | -5.081   | .000           | Significant |
| Post-test          | 18.38    |           |          |                |             |
| Experimental Group |          |           |          |                |             |
| Pre-test           | 15.69    | 15        | -6.267   | .000           | Significant |
| Post-test          | 21.50    |           |          |                |             |

Table 3 shows the paired t-test result in the pre-test and post-test scores of both the control and experimental group before and after using the contextualized module. The results of the study reveal a significant difference in the pre-test and post-test scores of both the experimental and control groups. Specifically, the control group shows a significant increase in knowledge and understanding from the pre-test to the post-test, with a mean score of 15.19 on the pre-test and 18.38 on the post-test. On the other hand, the experimental groups' scores from pre-test to post-test also increases, with a pre-test's mean score of 15.69 and post-test's mean score of 21.50. The statistical analysis reveals that the difference between the performance of the participants based on the results of their pre-test and post-test scores both in the control group and experimental group before and after intervention is statistically significant ( $p < 0.01$ ). Therefore,  $H_0$  is rejected.

The findings are directly in line with previous studies' findings such as a study by Abdi (2014), which stated that the experimental groups had a much greater understanding of the information covered, especially regarding questions that required interpretation.

Table 4. Difference between the Control and Experimental Groups' Performance on Geometry concepts during their Post-test

| Group Type   | <i>M</i> | <i>df</i> | <i>t</i> | <i>p-value</i> | Description |
|--------------|----------|-----------|----------|----------------|-------------|
| Control      | 18.38    |           |          |                |             |
| Experimental | 21.50    | 30        | -2.498   | .018           | Significant |

Table 4 shows the result of the independent samples t-test in the post-tests of the participants. A significant difference is found between the scores of the control group and the experimental group ( $p = 0.018 < 0.05$ ). Therefore, the null hypothesis is rejected. This means that the group exposed to the contextualized module of the lessons achieve better performance than the group not exposed at all. The group given the learning module have better understanding in the lesson covered compared to the control group.

These findings are supported by the study of Baker et al. (2009), which reveals that contextualization was a process built on the recognition that some students learned more effectively when they were taught in a hands-on, real-world context rather than in an abstract manner. It helped the performance of the students especially in relating it in the real situation and can be relevant to their experiences. It was identified as a promising strategy that actively engages students and promotes improved learning and skills development. It was clearly determined that using contextualized learning module was valid and effective. As Ballesteros (2015), studied and stated, that applying contextualization learning materials showed a positive effect in the performance of the pupils and it is an effective means of imparting life-long learning outcomes.

## CONCLUSION

Using contextualized module will help learners improve their academic performance. The contextualized module can improve students' learning outcomes. They can better comprehend the empirical applications of what they are learning and apply it in their everyday lives. Using contextualized learning module will increase the retention and mastery of the geometry concepts by the learners. Students are more likely to grasp and retain knowledge when actively engaged in hands-on activities instead of passively listening to instructional content delivered by teachers. Based on the intervention that has been conducted, students in the experimental group were visibly more active in class and develop self-confidence in their math skills when exposed to the contextualized module. Using the contextualized module approach in teaching geometry concepts, learners were able to participate in the teaching-learning process by identifying geometry shapes found in church architectural designs. The students who were exposed to the contextualized module approach improved their learning outcomes after their treatment period. Utilization of contextualized module can enhance students' learning outcomes through teachers' guidance motivations and strengthening the use of the said method.

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