Development and validation of contextualized lesson in mathematics

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Abstract. The poor academic performance of students in the Marawi City Division on Measurement was evident in the conducted summative tests. This perennial problem needs to be addressed by the school district. One way that can help boost students’ conceptual understanding is the use of contextualized lessons. This approach enables the students to engage in the procedural process that would improve their problem-solving ability. The purpose of this study was to develop contextualized problem in Measurement in coming up with a Contextualized Lesson Plan in mathematics that would improve the academic performance of the Grade students in their achievement test. This study used the quasi-experimental design with qualitative support. There were significant improvements to the students which belonged to the Experimental Group than those students in the Control Group. Moreover, students perceived that contextualized lessons as relevant and comprehensive. Since students displayed positive responses on the activities and improved their performance in the achievement test, the researcher, therefore, recommended teachers may adopt the use of contextualized problem in teaching Measurements in the mathematics subject.

Keywords: Contextualized Lesson, Mathematics Performance and Problem Solving

1. Introduction

One of the stated national educational goals is for the educational system to be effectively and efficiently responsive to the dramatic shifts in the academic landscape as well as to the changing needs and conditions of the global economic market. The central task in both public and private schools is to provide educational services that will lead to the development of human potentials. The schools will be able to creditably perform this task only to the extent that they provide relevant and adequate learning experiences for students.

With the implementation of K-12 Basic Education Curriculum Program in the Philippines, one of its educational goals in the Mathematics Curriculum is to provide opportunities for individuals to develop skills in preparing them for the workplace and participate in finding solutions to real-world problems. With this goal, the role of contexts in mathematics teaching and learning has gained much attention. The use of contextual problem engages the students in exploring mathematical concepts as they communicate with the real-world experiences.

Contextualized learning is rooted in a constructivist approach of teaching and learning. In a constructivist theory, individuals learn by constructing meaning through interacting with and interpreting their environment. Learners acquired their knowledge through their experiences. The implementation of contextualized mathematics instruction anchored on Realistic Mathematics Learning (RML) [7]. Two of the important views of RML are that mathematics must be closed to learners and be relevant to everyday life situation. Contextualized learning is a real-world application. Learning is based on the actual rather than abstract learning. Teaching and learning are effective when teachers use problems that are common and familiar to students’ direct experiences especially in a context of a compelling “presenting problem” in order to shape understanding [3].
There have been studies conducted that investigated the effects of contextualized learning in mathematics instruction. As described by Lave, she stated that contextualized learning (CL) is a situated learning where learning is embedded in the activity, context and culture [1]. Also, it was found out that contextualized learning helped improve the problem-solving skills in mathematics [2]. In addition, contextualization helped the students in their understanding of math problems and interesting to students [10], [11].

Kalchick and Oertle [8] supported the contention of Costillas [4] that teaching through a context is effective because students learn more effectively when they are taught in a hands-on, real-life situation rather than in an abstract manner. On the effects of contextualized learning in primary grades embraced the idea that contextualized lessons improved mathematical connection ability [4]. Furthermore, contextualized learning increases motivation and willingness to engage in mathematics activities [6]. It was claimed by Andriotis [1] that students likely to engage in mathematics activities when the instruction is embedded in a familiar context.

However, some researchers considered that contextualized problems allow diverse interpretation of the problem and that some students misunderstood the mathematical concepts [7]. This is because students’ experiences affect their interpretations of the context. Hence, the learners must be taught realistic situations in the classroom, which are similar to real-life situations. Undeniably, the conducted researches and literature show that no similar conclusions were made on using contextualized mathematics instruction approach. With this, Mathematics teachers express their concerns on contextualizing the learning resource materials in K-12 Basic Education Curriculum. To provide answers to this issue, this research study was conducted to present the process of developing contextualized lessons and determine student’s academic performance and perception in the implementation of Grade 7 Mathematics lessons.

2. Methods

This study utilized the quasi-experimental design. Achievement test was used to measure the performance of the students during the implementation of the contextualized activities. The achievement Test was a validated teacher-made pre-test / post-test which was used to measure students’ performance in both groups. The achievement test was composed of 20-item multiple-choice type of question with KR-20 reliability coefficient of 0.72.

The respondents of the study were the two sections of Grade 7 students of laboratory school in a state university in Mindanao. Per section was composed of 40 students as the sample during the school year 2017-2018. Moreover, the respondents from the two (2) sections where categorized according to the Control Group and the Experimental Group, which were composed of 30 males and 50 females.

3. Results and Discussion

Development of the Contextualized Lesson

Contextualized learning in mathematics must be close to the learners and relevant to everyday life situations. To implement this approach, mathematics teachers planned activities that gave the students opportunities to think and to solve the problems by applying the basic concepts in solving real-world situation.

Generally, lesson plans must adhere to the interest and immediate needs of the target learners and prepare them for the demands of the changing times which are paramount. Lesson plans must not only be abreast of the times but also it must be ahead of the times.
The process of designing the contextualized lesson as shown in Figure 1 involves the mapping of K-12 curriculum standards, the writing of contextualized problem, developing the learning activities, evaluating the lesson and implementing the lessons and determining students’ reflections.

**Figure 1. Process in the Development of the Lesson Plans**

**Mapping of K-12 Curriculum Standards to the Learning Objectives**

The first step in developing contextualized lesson was mapping of the K-12 curriculum standards to the learning objectives of the lesson. The objectives of the activities aligned to the K-12 Basic Education Curriculum to address the desired learning competencies required. The mapping of content standards and the performance standards set by the K-12 Basic Education Curriculum to the learning objectives of the developed contextualized lesson plans in measurement.

**Writing of the Contextualized Problem**

After the alignment of the objectives to the K-12 Basic Education Curriculum standards, the researcher then designed the lesson by writing the contextualized problem. The researcher developed four (4) lesson plans. The lesson plan started with a contextualized problem as springboard in the discussion of the topic.

The first lesson is on linear conversion. The problem was designed for the students to convert linear measurements. Teaching linear conversion by:

Consider the floor plan of Manican function hall (41yard x 22 yard), Sarip needed to decorate the hall with a binaning Mamandiyang. His binaning mamandiyang has a dimension of 38-meter wide and 20-meter long. Is the binaning mamandiyang enough to fit the function hall? Why or why not?

The second lesson is on perimeter. Since most classrooms were decorated with libot. The problem used the libot as context on introducing perimeter to the class. In this lesson students construct their answer by approximation and by conversion.

Mrs. Sacar wanted to construct a rectangular bulletin board for her Arabic chart. She instructed the carpenter that the board area must be 2ft by 3ft. She wanted to frame the chart with a libot around. How many yards of libot she needed?

The third lesson presented the concept of Area. The researcher observed that students can visualize Area using the sambayanga. The use of sambayanga instead of tiles in getting the area of the floor is a realistic problem to the students.

Ramadhan month required Muslims to pray tarawee right after the Isah prayer. If Basher mosque floor area measures 16m by 20m. How many Sambayanga needed to cover the floor area if Sambayanga area is 15.9 sq.ft?
The problem is similar to the Grade 7 problems on volume, instead of small boxes that can be kept in a big box. Teaching volume by using baor / kaban was done. Since most homes have this baor / kaban, students were familiar and were motivated to solve the problem.

Mrs. Jamila has wanted to keep her 10 dozens of glassware collection in a baor / kaban that measures 25in by 12 in by 15 in. If the rectangular glass is 5in by 3in by 3in, is the baor / kaban space enough to fit in all the glassware?

The four lesson provided opportunity for the students to create experiences that connect with what they had experienced in solving problems in measurement. In this case, the researcher assumed that the students valued their interest and motivated them to solve problems in mathematics.

**Implementing the Lesson Plans**

The process on the implementation of the lesson plans which included the drill and review, posting the problem, group work, evaluation and assessment. Peer sharing, brainstorming, and process questions were essential parts of the process. In implementing of the lesson, the lesson would begin with the teacher setting up the context in introducing the problem. Students then worked on the problem while the teacher closely monitored the students’ progress and then noted which students were using the approaches. Then the teacher started the class discussion. Students write their towards the activity. In here, the student-respondents were free to write their comments and suggestions based on the given activities. Through this student reflection, the teacher would know if the students understood and enjoyed the conducted activities.

**Comparison of Prior Knowledge Performance between Students in the Control Group and Experimental Group**

Further analysis was done using the t-test. In Table 1, it shows the comparison between the pre-test and post-test of the students in the Experimental and Control Groups. The result in pre-test score of the two groups revealed that the two heterogeneous sections were comparable. The mean score results on their performance in the pre-test of the Control Group (M= 6.37, SD = 1.27) and the Experimental Group (M=6.44,SD = 1.99) had a lower score prior to the intervention period. This suggests that they had the same level of knowledge on measurement.

Moreover, Table 1 also shows that there was a significant difference in the gain scores of the control Group (M = 3.09) and experimental Group (M =5.85), (t = -4.98,p=0.001) respectively. This further proves that contextualized teaching helped improve the problem-solving skills in mathematics. This result implied that contextualized problem solving improved performance in problem solving [4] [10].

**Table 1. Comparison of Students’ Performance in Pretest and Posttest**

| Group      | Test | N   | Mean | SD  | Mean Diff. | t-value | p-value |
|------------|------|-----|------|-----|------------|---------|---------|
| Control    | Pre  | 46  | 6.37 | 1.27| 3.09       | -4.98   | 0.001   |
|            | Post | 46  | 9.46 | 1.87|            |         |         |
| Experimental | Pre | 45  | 6.44 | 1.99| 5.85       |          |         |
|            | Post | 45  | 12.28 | 3.12|            |          |         |
Moreover, this study targeted to determine the students’ perception on the contextualized lessons. The results from the collected data in the self-reflection questionnaire revealed that the two (2) perceptions on comprehensive and relevant proved that students had favorable disposition towards the CL in teaching problem solving.

**Perception 1. Comprehensive**

In this study, most of the responses mentioned about the understand ability level of the lesson supplemented with the contextualized learning. The respondents noted their reactions:

- “I know how to convert properly-S1, S23, S15.”
- “Nice. I’ve learned something with this approach, compared to the past-S8, S13, S20.”
- “I have learned in this kind of instruction the easy way of analyzing and solving the problems – S9, S1, S24.”
- “I can understand what the teacher taught-S3, S12, S19, S14.”

With the given comments of the respondents, it showed that they enhanced their problem solving skill as they thoroughly analyzed the problem before answering and they understood the presented lesson and concept that led them to state in their answers the meaningful and useful topics and activities given during the data gathering procedure such as conversion, area, perimeter, pair activity, etc. The lesson given applied with contextualized learning established more permanent retention to the students seeing that they remembered the lessons very well. Students acquire learning when they understand the whole concept regarding it [6]. Additionally, contextualized learning occurs when the topic is related to the life experiences of the students, the delivery of the lesson was more comprehensive considering that the feedbacks of the students are like the following:

- “The lessons are understandable because we can understand question very well since the words used are contextualized.S10, 215”
- “I’ve learned from it and I would like to have more exercises.S12, S23”

**Perception 2. Relevant**

So, what is the best way to deliver the concepts that are taught so that all students can retain and use that knowledge? How effective can the teacher be in teaching the students who deliberated about the reasons, meaning and relevance of what they studied? What approach should be used to open the minds of students so that they could learn concepts and techniques to have an interactive and interesting session? The aforementioned questions were the challenges that teachers faced. Based on these questions, the contextual learning model was materialized to address the issue.

The respondents’ responses were subjected primarily on the content or flow of teaching. This means that the students were eager to engage in learning if the manner of teaching is new. With the context that they were exposed to, the performance of the students was enriched and established. The students were more attentive in comparison to traditional way of teaching.

- “I learned a lot because my classmates teach me how to solve the problem and with this, I can also say that I have developed by communication skill through engaging in pair and group activity. -S6, S9, S11, S19”
- “What I like about this contextualized learning is that, it makes easy for me to learn because the lessons were very relatable to real life situations – S2, S10, S26.”

- “The method of teaching is really amazing. I like how the teacher presents the lesson in an interactive way where her students can exchange insights with one another.-S18, S23”

The meaningful activities that both engaged students emotionally and connected with what they already know helped them build neural connections and continuous memory storage. This result supports the study of Jackaria et. Al [10]. The effectiveness of contextualized learning helped students recognized the patterns and put new information in context with the old. Students will not get motivated in learning and tend to forget and disengage the acquired knowledge if the lessons are not interesting, relevant and useful in their future endeavors[5].
4. Conclusions and Recommendation

Based on the findings of the study, the following conclusions were drawn (1) The developed contextualized lesson was aligned with the standard of K-12 Basic Education Program Curriculum. The use of real life scenario in problem solving activities provided the students to learn and increase their performance in the achievement test; (2) There was an improvement in the achievement test scores of both groups, post-test scores of the Experimental Group exposed on the contextualized lesson was higher than Control Group; and (3) Contextualized lesson approach had positive perceptions from the learners. The students perceived the contextualized lesson as comprehensive and relevant. With these conclusions, the researchers recommend that mathematics teachers may use the contextualized lesson plan to improve academic performance in math classrooms. It is an evident that by using contextualized problem solving increases motivation so as the student’s problem solving ability.

References

[1] Androitis, Nikos, (2017): Contextualized Learning: Teaching made highly effective! https://www.efrontlearning.com/blog/2017/06/contextualized-learning-effective-eLearning.html eLearning. Retrieved July 20, 2019
[2] Bostic, J., Yee, S. (2012). Developmental Perspective into Students’ Contextualization of Problem Solving. California State University
[3] Callahan, W. and Switzer, T.: Technology as Facilitator of Quality Education: A Model. College of Education, University of Northern. https://intime.uni.edu/direct-experience. Retrieved July 20, 2019
[4] Costillas, J (2015): Boosting Problem Solving Skills Through Situated-Cognition Teaching: An Analysis Based on Polya’s Framework. Journal of Educational and Human Resource Development. https://www.ijterm.org/index.php/jehrd/article/view/71.
[5] Davtyan, R. (2014): Contextual Learning, Technology Management, University of Bridgeport Bridgeport, CT, USA. Retrieved July 20, 2019
[6] Ginsburg, Linda, (2012): Contextualized Math Learning, Career Pathways Institute. http://www.paadultedresources.org/uploads/8/6/3/4/8634493/career_pathways_institute_math_handouts.pdf. Retrieved March 12, 2017
[7] Freudenthal, H. (1991). Realistic Mathematics Education Theory. Retrieved April 12, 2018 http://www.fisme.science.uu.nl/en/wiki/index.php/Realistic_Mathematics_Education
[8] Kalchik, S., Oertle, K (2010): The Theory and Application of Contextualized Teaching and Learning in Relation to Programs of Study and Career
[9] Perrin, Dolores, (2011). Facilitating Student Learning Through Contextualization Columbia University, New York, NY, USA http://journals.sagepub.com/doi/abs/10.1177/0091552111416227 Accessed March 2017
[10] Jackaria, M, Buan, A and Yuenyong (2019). Students’ Performance in Context-Based Lessons in Mathematics Classroom. Journal of Physics: Conference Series, 1340 (1), 012047 DOI 10.1088/1742-6596/1340/1/012047
[11] Ebal Jr, CD Luga, MJF Flores, MRO Zabala, DJP Buan, AT and Yuenyong C (2019). Linear Equations in Two Variables STEM Education Learning Activities: Developing the Household Power Consumption Calculator App. Journal of Physics: Conference Series, 1340 (1), 012048