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Conception and Application of Contextualization in Mathematics Education

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ABSTRACT

Contextualization is one of the keys of engaging the students in teaching-learning process wherein the students can relate their situations on their lesson. It makes the lesson meaningful and relevant to the students' lives by relating the students' context to mathematical content taught in school. This study covered the concepts and practices of mathematics teachers on contextualization. Moreover, it dealt with students' conceptual understanding of contextualized lesson in Geometry. The specific research design that was used in this study was a case study. The participants of this study were the 25 teachers in the junior high school public schools in the Philippines who have an experience in doing contextualization on their classroom activities in teaching Geometry. Specifically, five teachers were coming from Laguna, five from Quezon City, ten from Rizal, and five from Pampanga. These teachers are either handling grade seven mathematics or grade nine mathematics classes. Another participant of this study were the students of each teacher participant to check the contextualization practices of their teachers. A total of 25 students underwent semi-structured interview about the way they learned from their teacher's activities with contextualization putting emphasis to the real life application of Geometry. A semi-structured interview was used in this study in order to have a clear view about the concept of junior public high school mathematics teachers with regards to contextualization. Data were analyzed through thematic coding wherein the transcripts were written into phrases and related codes was grouped together. From the findings, math teachers have two ideas of contextualization – about the student's life and using local materials or information. These ideas came from the reference materials, internet and seminar-training conducted by DepEd which seen on their teaching pedagogies. Lessons delivered effectively and efficiently if the math teachers used available materials or information in the surrounding which created better understanding of math concepts. Context on students' lives made the class lively and engaging where the students construct their own meaning.

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1. Introduction

Over the two decades, problems on how to teach mathematics emerged including the difficulties on interpreting mathematical statements, conflict on the mathematics lesson analysis and real life experiences, and precocious exposure to the highly abstract mathematics lesson (Garfield & Ahlgren, 1988). Teachers' knowledge may also be an issue since not all teachers have their ability to contextualize their lesson and to create meaningful learning in teaching Mathematics (Papaieronymou, 2009).

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Traditionally, usual teaching in the middle school involves teacher-centered approach dominated by lecturing, abstract concepts, theoretical lessons and chalks and talk technique (Perin & Charron, 2006). However, these traditional approaches in teaching seem not effective in the modern times. In fact, learners now a days seek for new and challenging teaching pedagogies that will caught their attention and interest.

In some typical high school mathematics classrooms, teachers often give few examples and ask students to answer what is on the board. And students in such classes often listen to teachers and having their lectures, but hardly ever ask questions for some clarifications (Moltz, 2010). Probably, students not interested in the topic discuss nor they not motivated to the task given by their teachers.

Additionally, it was reported that students have lacks of sense in the community and at work, does not reflect their knowledge in the real world, and offers little room for the discussion (Artis, 2008; Berns & Erickson, 2001). Moreover, studies indicated that traditional way of teaching mathematics usually involve little active learning and causes students to become unmotivated and disengaged (Caverly, Nicholson, & Radcliffe, 2004; Misulis, 2009; Tilson, Castek, & Goss, 2010). To address this problem, teachers need to make a paradigm shift of teaching pedagogies so that their students get involved in teaching-learning process.

Contextualization, on the other hand, is another way of addressing the content of activities undertaken in the mathematics classroom (Castek, & Goss, 2010). Also, teaching the lesson in the real life context increases significantly the learning of students (Center for Occupational Research and Development, 2012). Likewise, contextualization motivates the learners to know, understand, and appreciate cultural heritage (Bringas, 2014).

On teaching approaches and pedagogies, it has to be noted that modification of teaching approaches should be improved once it was found that many learners cannot follow the lessons (Felder & Spurlin, 2005). Moreover, Tomlinson et al. (2003) suggested to the teachers to conduct contextualized instructions that will address students' readiness, interest and learning on a wide range classroom. This call for reform encourage maximum participation and development of students' learning.

Teaching students through concrete things before moving to abstraction lead them gradually from actual objects through symbols. This technique had shown to be particularly effective with students who have difficulties in Mathematics (Jordan, Miller, & Mercer, 1998). Connecting mathematical concepts through the use of objects create better retention and integration of concepts in physical world.

This approach is similar to the work of Jerome Bruner (Bruner, 1960) that teachers should start with the concrete components that includes manipulatives, tools, or any other objects that students can be handle during the instruction and moving to abstract components that includes symbolic representations such as numbers or letters that students can be write or interpret to demonstrate their understanding of a task. Through representations of abstract concepts by real objects, students can easily see the relevance of mathematics in their lives.

Witzel and his colleagues conducted a study of sixth and seventh grade students identified as having difficulty in learning algebra. Students who learned how to solve algebra transformation equations through contextualized lesson scored higher on post instruction and follow-up tests. Furthermore, students who exposed to contextualization performed fewer procedural errors when solving for algebraic variables (Witzel, Mercer, & Miller, 2003). This implied that contextualized lesson was better than the usual one.

Also, contextualized instruction has been shown effective in teaching mathematical computation which provides students greater access to understand mathematics curriculum (Flores, 2010). By the time that students reach their high school, the use of manipulatives in instruction has been forgotten since they are expected to know abstract concepts which is incorrect, for concrete representation should be continuous as students were exposed to a higher mathematical concept. The purpose of

teaching concrete to the students is to develop their understanding on the tangible mathematics concepts or skills they learn (Special Connections, 2005).

As pertain to the students, study shows that students have different ways of learning the subject matter, thus, it is the task of the teachers as a front liner to guide students and to think a strategy that is suited for the knowledge of the learners (Felder and Spurlin, 2005). This implied that trainings for teachers' conceptions and understanding must be aligning to the changing needs of the learners.

Notwithstanding, learners have different backgrounds, culture, and pace of learning that seems to be forgotten by some educators. This one issue needs to be considered that learners are unique and have different orientation the way they learn. Unfortunately, education in the Philippines have different set up. That teachers teach their subject matter based on how they see and assess learning by following standard goals set by the center for education which is too broad to consider since most of the schools in the country are far gone as compare to the mobility and accessibility of urban areas.

One of the main reasons why different institution continuous to discover different approaches is for them to help learners in the teaching-learning process and to cope with the different topics taught in school. Besides, it is the main goal of education to inculcate the learning in the minds of every learners and help them to understand mathematical concepts in an easy manner.

Thus, to contextualized means to adopt the present environment, setting, and situation modification to achieve equity of learning suited for all kinds of learners to relate their understandings in the real context of their life. This matter should be considered by educators as they proceed in the teaching-learning process (Brown, 2002). In order to deliver the lesson effectively, educators may adopt the context of the students' lives as starting point of the lesson wherein the students may feel the sense of belongingness inside the classroom. If the emotional aspect is first touch, engagement will follow.

A good interest to determine now is how this contextualization be applied in the field of Mathematics. What are necessary actions or modifications needed in teaching pedagogies to make it contextualized? When takes place in the lesson? These two questions are good start up in adopting contextualization in Mathematics. For the past years, mathematics was used in a real life situation using video technology that in the end improved the performance of the learners.

K to 12 curriculums specifically in the field of mathematics considered contextualization as another component of teaching which is, in one way or another, teachers in the Philippine Basic Education don't have a unified idea about the concept of contextualization. Different perspectives arose from the filed like using local materials, students' situation, historical backgrounds, environment, students' lives, etc.

In this light, this study aimed to determine the concepts and application of contextualization in the views of selected public junior high school mathematics teachers from grade 7 and 9 in teaching Geometry. Specifically, this study sought answers to the following questions: (1) what is the concept of junior high school mathematics teachers regarding contextualization? (2) How do the junior high school mathematics teachers apply contextualization in geometry? And, (3) Do the students understand the contextualized lesson based from students' interview responses and the teachers' reflection?

2. Conceptual Framework

Traditional way of teaching mathematics usually involves memorization of formulas and computations, which leads to learners' failure to understand deeper procedural connection within the problems. This way of teaching encourages limited understanding of learned ideas and concepts and poor problem solving approaches (Jordan, Miller, & Mercer, 1998). This conventional teaching seems to be the usual method used in the teaching-learning process which is seen to be lacked of real-life application of understanding specifically in the field of mathematics.

Context-based instruction would signify practices relating to real-life experiences, situations, and activities which gives meaning to the mathematics lesson. Contextualization takes place when the materials and methods in instruction where linked to the experiences and environment of the students (Jordan, Miller, & Mercer, 1998). Using local materials and information in teaching helps the students to fully understand the mathematical concepts.

Classroom assignments impact students by guiding their attention regarding specific parts of the substance and indicating approaches to process data (Paris, 2011). Contextualizing guideline concentrates on the interrelationships between ideas. This is rather than more subject-particular direction that stresses the introduction and review of data however not really the associations between them. Likewise, contextualizing direction causes students to arrange and incorporate learning by connecting with students' logical thoughts from numerous viewpoints while seeking after answers for important issues (Paris, 2011).

Contextualizing teaching is accepted to advance transfer of math thoughts to different settings, since students figure out how to relate content plan to issues and circumstances meaningful in their lives. Rich contextualizing highlights advance memory review and along these lines transfer (Felder and Spurlin, 2005).

Moreover, contextualizing instruction connects with students in dynamic utilization of their logical understandings. Dynamic adapting, instead of passive gathering, is required for students to pick up a comprehension of the use of their insight under various conditions. Dynamic learning in numerous settings is guaranteed to help the abstraction of information, and in this way transfer (Spring, 2010).

In any case, it has additionally been discovered that beginner students don't generally make associations between new data and prior knowledge or ordinary encounters in ways that are profitable for learning (Land, 2000). Scarcely investigations have explored the impact of contextualizing direction on the advancement of connections between mathematics thoughts and true circumstances and issues. Most research has been confined with regards to students' capacity to transfer data to new settings (Paris, 2011).

Indeed, even rarer have been classroom-based examinations that think about the connection amongst direction and learning. The present examination tends to these holes in the writing by taking a gander at students' utilization of contextualizing highlights amid sanctioning of an undertaking based math unit and connections to math learning.

Numerically capable students understand amounts and their connections in problems. They offer two correlative capacities as a powerful influence for issues including quantitative connections: the capacity to decontextualize—to digest a given problem and speak to it emblematically and control the speaking to images as though they have their very own existence, without essentially taking care of their referents—and the capacity to contextualize, to delay as required amid the control procedure so as to test into the referents for the images involved (Paris, 2011)

Mathematical understanding has three specific contexts namely: situational context, cultural context, and conceptual context. Situational context refers to the interaction of an individual with the same materials, environment, or actions. Cultural context refers to the patterns of behavior. The conceptual context refers to the personal understanding of the situation. These three contexts play vital role in developing mathematical understanding. However, this study focused on conceptual context only to answer the research question.

The socio-cultural theory of Vygotsky (1978) has gained recognition in the mathematics education community. This theory speaks that students' intelligence is a result of social interaction in the world (Sutherland, 1993). Over which the students have conscious control to language to build up a cognitive tool.

This framework descriptions' results will come up into understanding concept as students create mental constructions. This mental construction was further described by Sfard (1991) into two ways namely; operationally (process) or structurally (objects). Also, Thompson (1994) described the development of concepts in the terms of objects and process. He distinguishes that concepts were developed through figural knowledge.

On the other hand, the way a student interacts with their family and friends influence the way they think, behave and speak, which is transferred to other context including school and work (Gauvain, 2001). Classroom setting seems to be a complex context because it is a part of a larger world where common experiences of the students are associated yet individually, students have unique experiences that define them as person (Santoro, 2009).

Teachers' knowledge is also important on how to make mathematics meaningful for the students. They must have enough idea to show the use of the lesson into real life situation where students may understand and appreciate the topic. That is why it is very important that the teachers should have the same cultural background with the students in order for them to understand the lesson and see what's in the world in a similar way (Paris, 2011). Thus, this study used socio-cultural theory to perceive teachers' conceptual understanding about contextualization and how do they implement it in the teaching-learning process.

Hughes (2011) utilized concrete instruction and decided its consequences for battling students' acquisition, retention, and self-efficacy of fractions. The aftereffects of the examination recommend concrete instruction, as depicted in this investigation, is a compelling instructional technique to instruct portions to students who battle with arithmetic. All the more strangely, discoveries from this examination recommend that, for the students who took an interest in the exploration, the concrete instruction was more compelling than customary guideline on students' maintenance of parts learning. Students in this examination who got concrete instruction held portions data superior to students who got conventional direction.

On the other hand, Misquitta (2011) examined the effectiveness of the contextualized technique and explicit teaching practices to teach fraction equivalence to students struggling in mathematics. The contextualized approach included concrete aids such as fraction circles and fraction strips, representations such as pictures of fraction circles and polygons, and algorithms. Explicit teaching involved following a model-lead-test sequence and included an advanced organizer, corrective feedback and cumulative reviews. Results of the study indicate that the intervention program incorporating the contextualization and explicit teaching approaches is effective to improve students' performances in fraction equivalence tasks.

Yagci (2010) studied grade eight students exposing them with concrete instructions and also examine about students' views on concrete model instructions. It was found that using concrete materials in teaching, students positively understand the concepts. Through the use of concrete examples, students can easily connect concepts into reality.

In the end, schools, classrooms, and even teachers may affect students' motivations towards learning mathematics (Urdan et al., 2006). Moreover, it has been studied that thinking ability, attitude, and knowledge of the students were influenced by the family norms and values. Practical knowledge at this point had been developed through their everyday activities they had encountered in their daily basis thus, understanding contextualization is really important to determine the correct process of transferring information that can lead to students' better understanding on mathematics lesson (Mei-Zhao & Kuh, 2004).

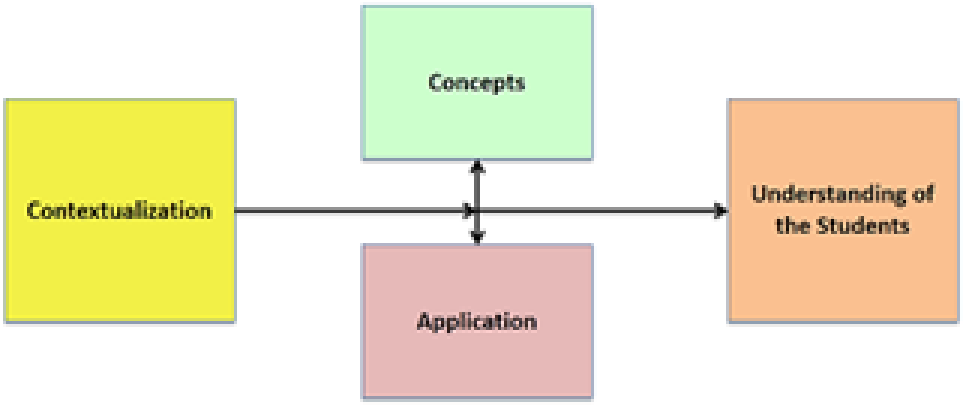

Figure 1. Conceptual Framework the Study

The figure above shows the two main constructs of the study, the concepts and application of contextualization in teaching Geometry. These two are important to determine because what the mathematics teachers view on contextualization is executed inside the classroom which has effect on the understanding of the students. If the teacher perceived contextualization as tool for effective teaching, better execution of the lesson would come which yield better understanding of mathematical concepts.

3. Methodology

3.1. Research Design

The specific research design that was used in this study was a case study. Case study involves the understanding of an issue explored through one or more cases within a bounded system. Qualitative case study was used in this research by interviewing the participants about the way they view and apply contextualization in teaching geometry, students' understanding about their lessons, and additional documents involving lesson plans and teachers' reflections were used to come up with an in-depth research results (Denzin & Lincoln, 2005; Merriam, 1998; Yin, 2003).

3.2. Participants and Sampling Method

The participants of this study were the 25 teachers in the junior high school public schools in the Philippines who have an experience in doing contextualization on their classroom activities in teaching Geometry. Specifically, five teachers were coming from Laguna, five from Quezon City, ten from Rizal, and five from Pampanga. These teachers are either handling grade seven mathematics or grade nine mathematics classes. A purposive sampling was used in choosing the participants of this study because of the criteria imposed such as experience in teaching Geometry and grade level required. Below is the teacher participants' demographic profile.

Table 1. Profile of the Teacher Participants

Variables	**frequency**	**%**	**Variables**	**frequency**	**%**
Sex			Grade level handle		
male	9	36	7	14	56
female	16	64	9	11	44
Total	**25**	**100**	**Total**	**25**	**100**
No. of Teaching Experience			Highest Educational attainment		
1-5 years	10	40	Bachelor's degree holder	11	44
6-10 years	9	36	MA units	9	36
more than 10 years	6	24	Masters' degree holder	5	20
Total	**25**	**100**	**Total**	**25**	**100**

The table above shows that the participants of this study were predominantly female and grade 7 teachers which implies male teachers were outnumbered in mathematics teaching profession. Moreover, many of them were new in this profession holding Bachelor's degree, but they're willing to pursue graduate studies.

Another participant of this study were the students of each teacher participant to check the contextualization practices of their teachers and to see if they really learn a lot if their teachers utilized contextualization. A total of 25 students underwent semi-structured interview about the way they learned from their teacher's activities with contextualization putting emphasis to the real life application of Geometry. Below is the demographic profile of the student participants.

Table 2. Profile of the Student Participants

Variables	**frequency**	**%**	**Variables**	**frequency**	**%**
Sex			Grade level handle		
male	12	48	7	14	56
female	13	52	9	11	44
Total	**25**	**100**	**Total**	**25**	**100**

Table 2 shows student participants in terms of sex and grade level. More female students were considered compare to male because most mathematics teacher participants were female; similarly more grade 7 students were interviewed because more grade 7 teacher participants than grade 9.

3.3. Instruments and Data Analysis

A semi-structured interview was used in this study in order to have a clear view about the concept of junior public high school mathematics teachers with regards to contextualization. This was conducted at the house of teacher because of summer break seasons. The interview guide follows the sequence of asking the participants concepts about contextualization, how do they apply this in teaching geometry for grade 7 and/or 9, and if the students understand the lesson through the process of contextualization.

Since data were gathered through interview, the researchers asked permission to the teacher participants to conduct the study and ask for their available time for the meeting and interview process. While, for the student participants, consent for the parents and students were asked before the interview and assured the confidentiality of the identity and information about the learners was maintained. Moreover, documents such as lesson plan and teachers' daily reflection were also considered through the process of analysis as supporting documents.

Voice recording were used in the process of collecting data. After the interview, transcriptions of the data were followed. Not only this beneficial from the aspect of remembering the details of each session, but immediately transcription served as a measure to help shape future sessions. Reading the complete transcription, while listening to the voice record was made. This allowed the researcher to correct any problems in the transcription.

Data were analysed through thematic coding wherein the transcripts were written into phrases and related codes was grouped together. The groupings of similar codes are called a concept (Kraus, 2005). Concepts are "words that stand for ideas contained in data. In other words, concepts are specific labels given to describe a specific piece of data. As the axial coding happened without a conscious effort, the first two steps namely open coding and axial coding was done (Kraus, 2005).

Ethical consideration upon the delivery of the study were followed strictly in order to protect the rights of each participant especially the rights of the students. Confidentiality of the results were maintained through the use of coding and pseudonyms.

4. Result

4.1. Mathematics Teachers' Views on Contextualization

Mathematics teachers' views on contextualization may affect the way they deliver the lesson. What the teachers believe is executed inside the classroom. Hence, if the teachers have positive views on contextualization, properly execution of the lesson might be happened which result better understanding on the part of the students. However, mathematics teachers have differently ideas on contextualization which may affect their teaching pedagogically. Below are the concepts of math teachers on contextualization.

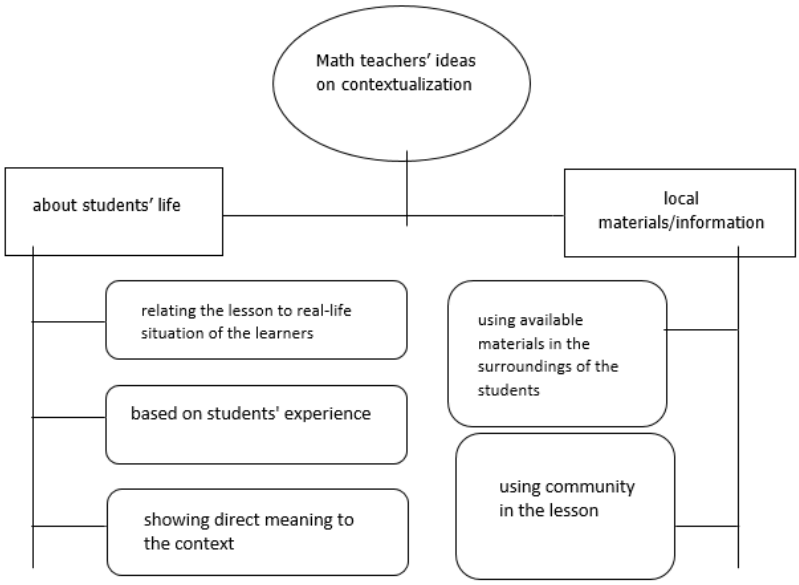

Figure 2. Mathematics Teachers' Ideas on Contextualization

The figure above shows the concept of mathematics teachers on contextualization wherein most of them thought that contextualization is relating the lesson meaningful to student's life which means using students' real-life situation, considering the students' experiences in planning the lesson and making sense of the word problem in mathematics were important aspects to consider in teaching Geometry. Lessons should be based within the context of the learner through different situations or using materials familiar to the learners wherein learners construct meaning.

"Contextualization is making sense of information from the situation or location in which the information was found or connecting the content in context." (Teacher 4)

"Contextualization is the process of helping the students to relate the lesson to their real-life situation. In this process, both the teachers and the students realized how the competencies become relevant and meaningful especially to the learners." (Teacher 6)

"Contextualization is when you present your lesson in a way your students were able to construct meaning based on their own experience." (Teacher 22)

Moreover, some teacher participants expressed their idea of contextualization as using local materials/information or community in the lesson. They believe that to deliver the lesson in Geometry effectively and efficiently, available materials/information must be utilized so that the learners can relate their lives on the lesson discussed by their teachers.

"It's my local materials and information around you for teaching, you do not have to be expensive (Teacher 10)

"This is where you use the available materials around the teaching school to better understand your child's lesson." (Teacher 12)

"For me contextualization is a process of putting ideas of the lessons into the community where students can relate to the lesson." (Teacher 17)

Table 3. Sources of Ideas of the Participants on Contextualization

Themes	Frequency	%
reference materials	6	24
internet	4	16
training/seminar	15	60
Total	25	100

4.1.1. Sources of Ideas of the Participants on Contextualization

Table 4 shows that primary source of the participants' idea on contextualization came from the training and seminar they attended. These seminars and trainings were conducted by DepEd Divisions or Regional Offices for the in-service training. Less likely came from internet, but some use reference materials like modules, teacher's manual, etc. That means, there is a widespread on the idea of contextualization in teaching field.

" Through attending the series of seminars and trainings conducted by DepEd." (Teacher 6)

" In the k-12 seminars, it really explains a topic is localization and contextualization." (Teacher 14)

Table 4. Examples of Contextualized Lessons

Topics	Core ideas
Things inside the classroom	using, door, windows, ceiling
local materials	using improvised materials
Things within the community	using surroundings, buildings
Analogy to life	compare to life

4.1.2. Examples of Contextualized Lessons

Table 4 shows the topics and the core ideas of the participants on the examples of contextualized situations. Teacher participants used things found inside the classroom in teaching the concepts of Geometry since these are available immediately. Similarly, they used local materials like walis tingting, tali, stick and apa, to represent the geometric figures, while buildings, garden, rice field and water tank to show the concepts of measurement. One teacher participant compared life into circle because of the similar properties of the two.

"Using objects inside the school like window, ceiling, buildings as examples of geometric shapes." (Teacher3)

"When teaching angles, ask the students to draw lines, connect them and ask what is formed when lines are connected. Use manipulatives like walis tingting, yarn or whatever materials available. Give them real-life problems that will make them think." (Teacher 9)

"Geometry talks about figures such as angle and circle. Our life is like a circle that has no ends. We may sometimes experience happiness, sadness and other repenting." (Teacher 6)

Table 5. Participants' Idea on the Process of Contextualization

Themes	Core ideas
integral part of the lesson	part of teaching process, follow the curriculum guide, first step in lesson plan
relating to the students' life	using real life situation, students' experiences and life
available local materials/situation	using local materials, common situations

4.1.3. Participants' Idea on the Process of Contextualization

Table 5 explains the participants' idea on the process of contextualization. According to them, first it must be the integral part of the lesson which means it is about planning of activities to be

implemented going to abstraction. It is more on knowing the life of the students first. Hence it is a part of teaching process by following the curriculum guide, and it must be in the beginning of the lesson plan. Second, it must be giving real-life situation related to student's experiences wherein students may reflect themselves on the situation. Lastly, it is using the available local materials in teaching to efficiently deliver the lesson.

"First plan your lesson, second think about the situation on the lives of learners, and use the situation in teaching." (Teacher 3)

"Contextualization process is not a single click of your fingers, it is about planning from the activities to be implemented, the application part and even the abstraction part." (Teacher 7)

"When you contextualize, you need to learn the background/experiences of your students and try to integrate to your lesson." (Teacher 24)

4.2. Application of Contextualization among Mathematics Teachers

Table 6. Ways of Utilizing Contextualization

Themes	Core ideas
picture of shapes in the environment	showing picture of sceneries, environment
available local materials	using local materials
interactive group activity	games, sports
students' context	real life situation

4.2.1 Ways of Utilizing Contextualization

It can be gleaned from the table the different ways of utilizing contextualization. Some teacher participants used picture of shapes in the environment by showing pictures of the sceneries like rice terraces, mountains, rice field or environment like garden, park and forest. While others use available local materials like walis tingting or yarn as line, board as plane, and object around as solid. However, some teacher participants utilized interactive group activity like games and sports, or by situations relating it to the life of the students through drama, skit or play.

"Various activities such as games, flashcard rely, sports." (Teacher 9)

"Show the students an architectural structure like buildings in Manila or provinces like capitolyo, museums, municipal hall." (Teacher 16)

" I started with the problem using situation on the life of my students. I used local materials within the community like bayong, pamaypay." (Teacher 20)

Table 7. Teaching Materials Used by the Math Teachers in Geometry Lessons

Themes	Core ideas
ICT tools	electronic gadget
Mathematical tools	teaching equipment
Instructional materials	common materials

4.2.2. Teaching Materials Used by the Math Teachers in Geometry Lessons

The table above reveals that math teachers used ICT tools like TV, computer, and calculator in teaching their lessons. Similarly, they utilized mathematical tools like dice, cards, protractor, and ruler in teaching, but they made instructional materials like leaves, sticks, pictures, ice cream cone, ball and eraser in teaching geometric concepts so that the students can relate easily the concepts to their lives.

"Often simple materials are used. There is only one leaf or popsicle sticks available." (Student 8)

"He uses materials that are only available to the community. Examples po dice, ruler, protractor, calculator." (Student 10)

As the proofs of contextualization practices of teacher participants, excerpts from their lesson plan were considered (Appendix 1).

The statement above shows how math teacher formulated the evaluation part where the topic was finding the area of a polygon on coordinate plane. Teacher used satellite in sky as context of the problem where the students plotted the coordinate points to trace the polygon and solve for its area. Rubric was utilized to score the student's output as their guide in accomplishing the given task.

To check the contextualized teaching practices of the math teachers, responses from the interviews of their students were considered. Below is the result of the interviews from the students about the contextualized lessons in Geometry.

Table 8. Ways on How Math Teachers Relate the Lesson to their Students' Lives

Themes	Core ideas
real-life situation	money, height
buying and selling goods	expenses, profit, budget, savings
measurement	available tools

4.2.3. Ways on How Math Teachers Relate the Lesson to their Students' Lives

The table above shows how math teachers contextualized the lesson in Geometry as experienced by their students. Math teachers used problem solving about computing for the amount of money left after buying, height of houses, budgeting certain amount of money, profit obtained after selling goods, expenses in everyday living and measuring objects using ruler and tape measure. This means math teachers have variety of pedagogies in inculcating contextualization on their lessons.

"For example, the sample is home to a sample size or height." (Student 9)

"It's a lesson to our experience, for example, using a ball, ruler, dice." (Student 25)

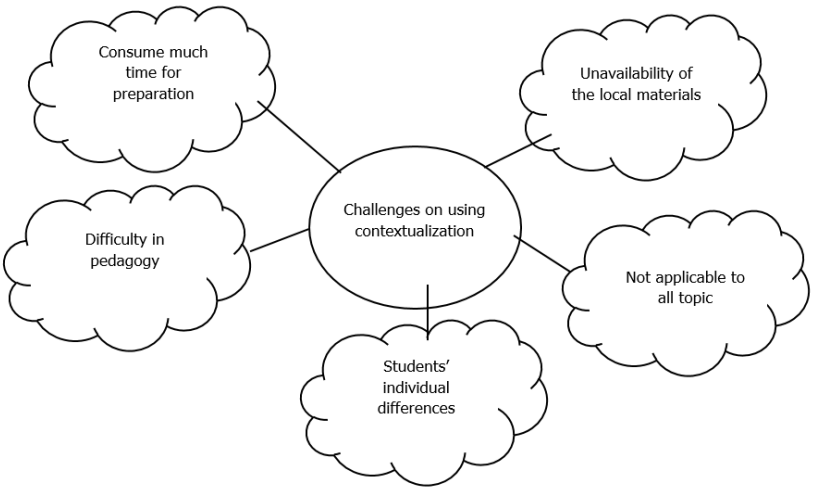

Figure 3. Challenges Experienced by the Teacher Respondents on Using Contextualization

The figure above shows the challenges experienced by the mathematics teachers in teaching Geometry using contextualization. Teacher participants experienced time consuming for the preparation of materials if they contextualized the lesson. They make careful planning of the local materials to be used efficiently because not all materials are available within the community immediately. They need to find suitable materials to their lessons. Moreover, teacher participants experienced difficulty in teaching pedagogy because there were some lessons that were hard-to-find strategies to make those lessons suitable to different types of learners. This is due to students' individual differences in background, attitude and interest. Similarly, there are some topics in formal mathematics cannot be contextualized like proving theorems, radicals, and roots.

"Time consuming sa preparation ng materials, hindi agad-agad available ang local materials." (Teacher 8)

"It's hard to find suitable situations and materials to be used in the process of contextualization." (Teacher 19)

"Things that may seem contextualized to one student may be different from other student."(Teacher 18)

"Not all topics are easy to think like that especially if math is more on higher math, square root, like radical, x and y." (Teacher 14)

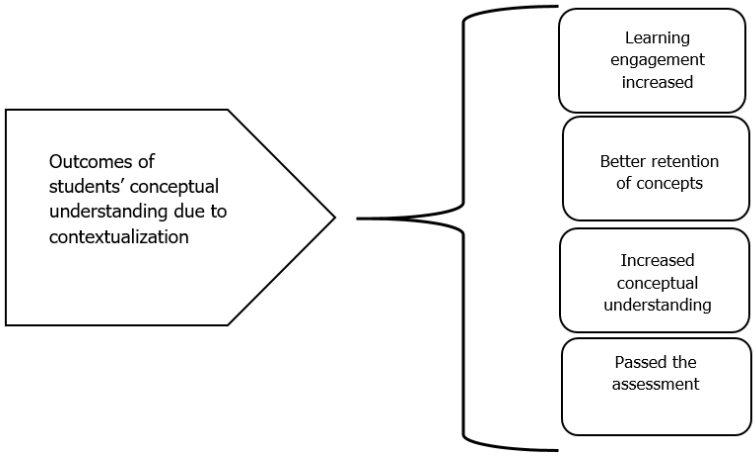

Figure 4. Outcomes of Students' Conceptual Understanding on Contextualization

The figure above shows the teacher participants' perception on the outcomes of students' conceptual understanding on mathematical concepts because of contextualization. Due to contextualization, students were more engaged in school work and find enjoyment in lesson. The concepts learned retained longer in their minds because they easily grasped the relevance of topic. Students appreciated the math concepts despite of its abstract nature because they were able to connect math concepts to their lives. Moreover, conceptual understanding was increased which result a better learning outcome as shown in passing the assessment part of the lesson.

"Able to understand in deeper level, make them realized that it matters on their lives." (Teacher 15)

"They learn the lesson better while having fun because the lesson seems relatable."(Teacher 18)

"It is more on cognitive learning outcomes. They were able to pass the assessment given by their teachers." (Teacher 23)

Table 9. Students Understanding of Math Concepts through Contextualization

Themes	Core ideas
better understanding of concepts	more concepts retention, relevance, better learning
performing well	motivated students, pass the evaluation

4.2.4. Students' Understanding of Math Concepts through Contextualization

The table shows student understanding of math concepts. Due to contextualization, students better understand the concepts of Geometry, its meaning, relevance and implications which result better learning. They were able to appreciate and apply the geometric concepts to different problems in their lives and performed well in school work because they were more engaged and enthusiastic to perform the task given by their teachers even in examination.

"Through contextualization, for example in teaching circle, students' interest and achievement in the said topic improve dramatically when they are helped to make connections between new knowledge and experiences they had, or with other knowledge they have already mastered." (Teacher 1)

"They were able to apply the lesson in their daily living, thus it makes them appreciate schooling and have fun at the same time." (Teacher 24)

To support the statement of teachers on conceptual understanding of their students, their reflections were considered if after teaching Geometry through contextualized approach gained better result or not. Below are some teachers' reflections.

"Contextualization is very useful in teaching mathematics particularly in Geometry. It is one way to go away with the traditional model of instruction which is very typical in teaching math. They can be able to concretize concepts in mathematics and the presence of math in the environment. That everything that surrounds us have patterns that can be explain by mathematics like the leaves of the trees or plants, flowers etc. For instance, using walis tingting in representing lines, tip of ball pen as point and black bard as plane, students can formulate their own meaning of the basic terms in Geometry. However, not all mathematical concepts can be discussed or presented using contextualization especially the proving theorem." (Teacher 5)

The reflection above states the usefulness of contextualization in teaching Geometry. Using concrete object to represent the math concepts helps the students to visualize the meaning and relevance of the lesson. Moreover, available materials in the surrounding can be used as representation of the math concepts which bridge the prior knowledge of the students to the new concepts. On the other hand, some topics in Geometry have formal nature wherein contextualization is hard to integrate because of the mathematical structure of algorithms.

"Sometimes, it's hard to find local materials that can be used in teaching concepts in math. But most of the time, contextualization is very powerful. For what they see around, they can be able to math concepts in real life situations. And what they did every day related to math, they had the mastery of the lesson. The social aspect of math, that the things around apply math especially in business, helps very well. They can balance everything, to be able to survive." (Teacher 13)

The statement above shows the power of contextualization in teaching Geometry despite of scarcity of local materials. Materials in the surroundings of the learners or even their daily activities can be used in teaching which may create sense of belongingness where the learner established connections of math concepts to their lives.

"I often use contextualization, because the children I own are STE. Most of them are academic. Advance their math and pure computation, from concretization to abstraction with the presence of real object. Like a geometric model like ice cream cone, ball, boxes. They are easier to understand concepts and derivation of formulas." (Teacher 21)

The reflection above reveals that even in science sections with advance math subjects, contextualization may be used in teaching Geometry. Even in teaching higher math with lots of computation, concrete objects may be used to represent the math concepts and reveal the connections of one concept to another concept.

Table 5. Evidences of Students' Understanding

Themes	Core ideas
active creator of meaning	define terms, compare and contrast
application of concepts	solve real life problem,
student's output	project, portfolio, journal
passing the summative assessment	exam, quiz

4.2.5. Evidences of Students' Understanding

It can be gleaned from the table above that the evidences of students' understanding after using contextualization, these are they able to create their own meaning of the geometric terms, compare and contrast those terms, give concrete application of concepts, provide student's output like community project, journals, or portfolio, and passing the summative test.

"The students get the meaning of the term if the teacher uses real-life situation." (Teacher 2)

"Students' portfolio and their own examples of real-life problems involving geometrical problems." (Teacher 5)

"Better exam and test results, increased volume of students participating in the discussion/recitation, application, and contextualization itself comes from them." (Teacher 21)

5. Discussion

Contextualization should be applying as a process of leveraging students' knowledge by bringing the students' concepts from their home, and community and connect them to classroom situation (Paris, 2011). Through this process, students can relate their lives on the topic discussed in math class wherein sense of belongingness felt which caused engagement in school work. It is just like learning while having fun. Using the context on student's life makes the lesson relevant and meaningful on the eyes of the students.

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.

Teachers may use pictures of sceneries or environment to represent the math concepts, local games, or materials immediately available within the community to facilitate concepts development on the mind of their students. Improvised teaching materials from local products may be used as alternative tool for teaching. Through teachers' creativity, the flexibility and resourcefulness of teachers came in when the materials scarcity was experienced.

Contextualized teaching is by connecting real-life context to the culture of the learners (Spring, 2010). It is a teaching process that connects lesson directly to a concrete application that will be appealing to the students' interest (Perin, 2011) thus, teachers should use activities, events, issues or real materials to meet the needs of the students. Using local materials available within the surrounding, it makes the lesson lively and appropriate on the students' level of understanding. Moreover, situation within the community can be used as starting point of the lesson to catch the attention and engagement of the students on school work.

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.

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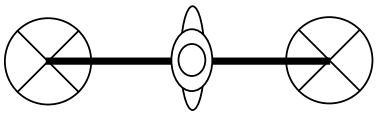
APPENDIX 1

Motivation:

Activity 1. Do the activity below.

1. If you were to put a coin into a bottle and then insert a cork into the neck, how could you remove the coin without taking out the cork or breaking the bottle?

2. Interpret the figure below:



Activity 2. Name me

Direction: Go around the school; see different objects with different shapes. List at least 3 objects within the school represents point, line and plane

The excerpt motivation above shows how math teachers utilized the local materials in introducing the lesson and used the surroundings as the start of the lesson. This part of the lesson allows the students to explore or discover connection of math concepts in physical world. Teachers tried to connect the prior knowledge of the students to the new lesson - undefined terms in Geometry.

Below is an excerpt from the lesson plan showing contextualized problem solving.

Application

Directions: Answer the following problems.

1. During the shooting of an episode location in Kalyeserye of Eat Bulaga, the floor director made a fence with the following coordinates in a polygonal grid, (-7,3), (1,7), (-2,-6) and (2,3). What geometrical figure is formed? Find the perimeter of the location.
2. The Zumba Teams in the town of Calamba City, Laguna joint forces for a "Zumba for A Cause" Project to be held in Tanay Retreat House. The area, if to put in a Cartesian plane has the following coordinates, (-3,4), (1,3), (-3,-10) and (-7,-3). What geometrical figure is formed? Find the perimeter of the retreat house.

The excerpt above shows how mathematical word problems formulated using the local information related to the lives of the learners. The topic here was solving for the perimeter of a polygon on coordinate plane where the teacher used TV show and fun rising activity as the context of the problem so that the learners' interest would come in immediately.

To complement more, below is the excerpt from the lesson plan showing how evaluation part formulated by math teacher.

EVAUATION

Direction: Answer the given problem.

A satellite is seen like a star in the sky during nights moving swiftly in the given coordinates F(2, 8), G(4, 4), H(2, 0). Solve for the area of the shape formed by the movement.

Scoring scale:

5-with illustration, formula, computation, correct answer
4 - no illustration, formula, computation, correct answer

3 - no illustration, with formula, with computation, wrong answer

2 - no illustration, no, computation

1 - there was an attempt to do the activity