Reflections on the Least Learned Competencies in Mathematics

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***Abstract*—** This study aimed to determine the reflections on the least learned competencies in Mathematics of Grade 10 students of Jupi National High School for school year 2020 – 2021. The participants of the study were 20 Grade 10 students. Mixed method of research was utilized as research design of the study. Quantitative method for the academic performance using summative tests while qualitative method for the reflections of the students were their responses were gathered using interview guide. The study revealed that students performed very satisfactorily in permutation and combination. However, they performed satisfactorily in coordinate proof, equation of circle, and problems involving circle. The overall performance Grade 10 students was very satisfactorily because of the mean performance is 84.92. The least learned competencies of the students as revealed by their reflections the selected topics in mathematics were solving problems along permutation, combination, and circles, proving theorems, finding the equation, and plotting of points and graphing of circles. This study also revealed Student-related factors, home related factors and subject-related factors which hampered in their learning the competencies in Mathematics. A lesson plan exemplar was developed in order to address the least learned competencies by the students in Mathematics.

***Keywords*—** Reflections, Least Learned Competencies, Mathematics, Academic Perfiormance.

INTRODUCTION

Mathematics is an essential subject matter that is taught at all levels of education. Mathematical understanding refers to student's grasp of fundamental mathematical ideas which influences decision making in all areas of life, social, and civil. Mathematical skill can make students become effective in realizing the different roles they take over in their daily lives. The development of mathematical understanding and skills are needed by the learners to attain the notion of being productive as they execute their role in the society

According to Anthony and Walshaw (2009) mathematics education is a key to increasing the post-school and citizenship opportunities of young people, but today, as in the past, many students struggle with mathematics and become disaffected as they continually encounter obstacles to engagement. This struggle can be seen in all educational institutions all over the world and tested by assessing students' understanding through different assessment tools to measure their capabilities.

Assessment is the process of gathering evidence about a student's knowledge of, ability to use, and disposition toward Mathematics, and of making inferences from that evidence for a variety of purposes as stated by the Assessment Standards for School Mathematics of the National Council of Teachers of Mathematics. In connection with this, the Philippines decided to let the Programme for the International Student Assessment (PISA) of the Organization for Economic Co-operation and Development measure the effectiveness of its basic education curriculum. Based on the 2019 International Assessment, the Philippines is in a major crisis because it ranked lowest among 58 countries in Mathematics and Science. The dismal result is so depressing and should serve as a wakeup call in all education stakeholders in the country.

The country's poor performance in the PISA "only validates the alarm that teachers have been ringing for the longest time". This result become a challenge to the Department of Education to provide interventions for the low performances of the students in mathematics. In order to address these challenges, DepEd focused on the core components of Sulong Edukalidad which centers on the K to 12 Curriculum review and update, improving the learning environment, teachers upskilling and reskilling, and engagement of stakeholders for support and collaboration. Even though there is an ongoing program implemented by the Department of Education, the problem on the low performance of students in Mathematics continues.

Moreover, the students generally considered Mathematics difficult particularly in these basic concepts in Mathematics. First in the probability concepts in combinations and permutations which is according to Busadee (2013) were difficult to grasp, especially when students are taught by formal mathematical presentation without having gone through sufficient real-life situations. Second concept is problem solving which students' attitudes vary when they heard

this topic. Generally, they have negative views on solving problems. Meerah and Tambychik (2010) stated that problem solving is one of major aspect in Mathematics Curriculum which required students to apply and to integrate many mathematical concepts and skills as well as making decision. Third is the geometry concepts specifically coordinate proving and circles which is according to Wicaksono and Martyanti (2019) misconceptions may arise in the process of learning the concepts.

Competencies help students draw and build upon what they know, how they think and what they can do. In school, students develop and apply competencies through subject-area content and learning experiences. But in reality, students have difficulty in achieving required learning competencies in certain math concepts. This difficulty can possibly be worsened because of the impact brought by the COVID-19 pandemic transforming face-to-face learning into modular learning. The change of learning approach gave the idea on the Department of Education to reduce the full K to 12 Curriculum Guides in competencies to the MELCs (Most Essential Learning Competencies) which only focus on the most essential and indispensable competencies that the learners must acquire.

In Jupi National High School, the researcher, who is a Mathematics teacher as well observed that before the pandemic, Grade 10 students experienced difficulties in some concepts in Mathematics which influence the underachievement in some of the learning competencies. The researcher also observed that only one-fourth of the class were focused on learning the concepts.

This notion provided the researcher the idea that students must have time to reflect on why such difficulties are encountered by the students as a self-reflection is a potentially promising pedagogical approach for supporting math learning. This idea is important to know deep insights of the students while learning and solving different mathematical problems and concepts. It is essential for teachers to emphasize growth and learning in Mathematics, and de-emphasize performance, in order that students stay motivated and encouraged about their learning.

This idea was supported by the latest learning approach demanding teachers to use modules catering to the most essential competencies. This gave students an avenue to reflect on their experiences in answering activities that are aligned in every concept/topic in the module. Every module that students need to input their reflection which showed the way on how they react to learning the fundamental concepts in Mathematics. This transformation of learning approach was a big challenge to the teachers and school heads to think for an intervention programs that may help students acquire needed learning competencies and innovate strategies in teaching mathematical concepts to make it motivating and easy to comprehend.

With this, the researcher investigated the least learned competencies through students' reflections on certain topics in mathematics cited above and the different factors affecting the acquisition of skills wherein it can be used as a guide for teachers in improved instruction and enhancement teaching methodologies and strategies.

METHODOLOGY

Mixed method of research was utilized as research design of the study. Quantitative method was used to measure the academic performance using summative tests. Five summative tests were utilized one each for the following topics: coordinate proof, equation of a circle, problems involving circles, permutation and combination. Test scores were transmuted and analyzed using scale. Qualitative method was chosen to gather the reflections of the students using interview guide. The 20 participants of the study were randomly chosen among Grade 10 students of Jupi National High School for school year 2020 – 2021.

REFLECTIONS ON LEAST LEARNED COMPETENCIES IN MATHEMATICS

1. Academic Performance of the Students

Table 1 contains the academic performance of the students along with the topics coordinate proof, equation of a circle, problems involving circle, permutation, and combination. The mean performance is also included in the table.

Table 1: *Academic Performance of the students*

Topics	Performance Level	Description
Coordinate Proof	83.45	Satisfactory
Equation of a circle	83.70	Satisfactory
Problems involving circle	82.95	Satisfactory
Permutation	87.7	Very Satisfactory

Combination	86.8	Very Satisfactory
Mean Performance	**84.92**	**Very Satisfactory**

The data revealed that the performance level of the students in coordinate proof is 83.45 which falls on satisfactory performance and as shown in the table they performed satisfactory in equation of a circle which has a performance level of 83.70. Students' performance in problems involving circles is fairly satisfactory because they have a performance level of 82.95. Meanwhile, students have very satisfactory performance in permutation because their performance level is 87.7 while their performance in combination is 86.8 which is also very satisfactory. Generally, the mean performance of the students on the specified topics is 84.92 which described as very satisfactory.

The performance of the respondents along coordinate proof, equation of a circle and problems involving circle is satisfactory. This means that the students may have found difficulty in understanding these topics. The topics may be complex in its nature which brings hard understanding on the part of the students that is why their learning is affected. Lack of knowledge on the fundamental ideas or basic concepts prior on the said topics may be the reason on the low performances. The broad range of the topic circles may arise confusion that can affect students' way of understanding. It would imply that the teachers have to be innovative in teaching this topic so as the hard concepts have to be made simpler and easy to understand by the students. The learning task to be given to the students has to include examples which varying level of difficulty in order to cater all types of learners.

However, the performance of the respondents on permutation and combination is very satisfactory. This means that the topics were not as complex as on circle that is why some students understand it well. It reflected on the performance that competencies along the topics were acquired by some. Students' attitude towards the topics plays big role and can affect their learning. It implies that teachers may developed enrichment activities that may help students to enhance skills on the topics and give way more practice tasks to have mastery and lessen chance-medley.

The result is supported by the study of Akhter (2018), which show that many students find mathematics to be difficult and unrewarding and there is a tendency for students to opt out of studying mathematics as soon as possible. It also showed in their study that mathematics is usually seen to be important and holds a central place in the curricula in most countries. Mathematical ideas find application in numerous areas of life and in many careers. Thus, negative attitudes among students may have important ramifications for career choices and contributions in wider society. Generally, there were differences in attitude in what is required by the students and what is occurred in classroom where the learners are taught Mathematics. So, it suggests solutions about the competencies of students to work through mathematical difficulties.

2. Least Learned Competencies of the students as revealed by their reflection

This section contains the competencies least learned by the students along the selected topics as determined from their reflections. It can be depicted on Table 2 that some competencies that were difficult to understand by the students.

Table 2: *Competencies least learned by the students*

Topics	**Least learned competencies**
a. Coordinate Proof	1. Plotting points. 2. Proving theorems
b. Equation of a Circle	1. Finding the equation of a circle given its center and diameter. 2. Transforming the standard form to center-radius form and vice versa.
c. Problem Involving Circles	1. Problem solving involving circle
d. Permutation	1. Computing the permutation of an object. 2. Solving problems involving permutation
e. Combination	1. Distinction between permutation and combination. 2. Solving problems involving combination

Coordinate Proof. It can be observed from the table that relative to coordinate proof, the student's least learned competencies are plotting points, and proving theorems. Almost 50% in the competencies required in the learning activity sheets were least mastered by the students.

One of the participant said ***"I don't know to use the variables in the midpoint and distance formula so that I can't plot each set of points in a coordinate plane".*** This show that not acquiring the basic skills may affect the performance on the succeeding topics that it why it reflects on the satisfactory performance on the summative test. A study of Uğurel, et al. (2015) which is focused on and explains pre-service secondary mathematics teachers' behaviors throughout the proving process of a proposition. The findings of their study show that pre-service secondary mathematics teachers' behaviors and thoughts regarding the given proposition were limited. In detail, they had difficulties in application of mathematical language and notations, understanding the meaning of the given proposition, knowing where to get started on a proof, using examples efficiently, using appropriate and efficient methods to construct the proof, and defining logical structures of the proposition to construct the proof.

Equation of a circle. Similarly, the difficulties encountered by the students on equation of a circle are finding the equation given the center and diameter and transforming the standard form to center-radius form and vice versa. There were 50% in the most learning competencies required in the topic were less understood.

One of the participant mentioned "***I don't understand the topic equation of a circle because I'm filled with confusion when it comes in getting the center and radius of a circle so I can't solve it."*** It can be included that there can be misconceptions in understanding the formulae that lead to broader difficulty. This implies that the teachers must be innovational in creating teaching materials that can facilitate students to reduce mistakes in the concept of circles. Enhanced model, method, media, strategy or technique is needed to help students understand the concept of circles. The study of Sudihartinih (2018) showed that 75% of the students experienced errors on the concept of circles after learning the concept of circles in basic mathematic lectures.

Problems involving circle. Along the topic problems involving circles, there were 2 least learned competencies shown in their reflections these are graphing a circle and problem solving. One hundred percent of the required essential learning competencies were not achieved by the students.

One of the participant expressed that ***"It's hard for me to solve problems in circles because I don't understand the words used that why it's hard to solve".*** It means that if students have poor comprehension, it would be difficult for them to solve problems even though there are so many examples presented. When it comes to word problems, students have inability to comprehend and interpret the sentences in order to proceed on the next process to reach the conclusion. This would imply that teachers must establish a reading plan suitable for students' capabilities to help them improve their comprehension skills. A study of Nurkaeti (2018) analyzed problem solving difficulties of elementary school students based on Polya strategy which is a strategy of problem solving that can be developed in mathematics learning. The results showed the difficulty of mathematical problems solving of elementary school students consist of the difficulty of understanding the problem, determining the mathematical formula/concepts that is used, making connections between mathematical concepts, and reviewing the correctness of answers with questions. These happened because the problem presented is in a story problem, which is rarely studied by the students. Students usually solve mathematical problems in a form of routine questions, which only require answers in a form of algorithmic calculations.

Permutation. The least learned competencies of the students relative to this topic are computing the permutation of an object, and solving problems involving permutation. Only 25% of the required essential learning competencies were not achieved by the students.

Participant mentioned that ***"The problem solving part because I don't understand the formula to be used".*** This indicates that the students have confusion on basic topics that is why they find it difficult to grasp the concept. Also slow comprehension is a big factor that affect their strategies on how to understand hard problems related to the topic.

It implies that teachers must be very observant taking into consideration the possible misconceptions of some students that may arise when teaching this certain topic for them to plan more effective teaching and learning strategies in making the classroom activities for Permutations meaningful. Rosli (2016) identified errors in Permutations and Combinations topic among matriculation college students. The findings showed that students made five major errors: 1. Wrong question interpretation. 2. Wrong identification of the type of object used either identical or different, especially letters, numbers and non-living things. 3. Wrong arithmetic operations used in finding solution. 4. Incorrect use of formulas and 5. Wrong or meaningless answers given.

Combination. Meanwhile, the students found difficulties in combination that includes the distinction between permutation and combination and problem solving. Fifty percent of the required essential learning competencies were not achieved by the students.

One of the participant stated that ***"I don't understand which among the problems are permutation and combination because it's almost the same".*** It means that it's hard for the students to distinguish the difference of permutation concept to combination concept and also solving problems involving combination. This implies that teachers must give more drills in teaching the topic for the students to be familiarize with the unique ideas of the said topics and they can work out on some enrichment activities to help students develop higher order thinking skills and reading comprehension skills.

Kapolyo and Leonard (2019) investigated the impact of Problem Based Learning teaching method on pupils" performance in permutation and combination and its influence on the attitude of the learners. The pre-test and post-test given before and after the intervention shows that there is a change in participants" performance in Permutation and Combination over a four-week intervention period in comparison to those who were exposed to conventional methods of teaching. Their study concluded that Problem Based Learning had a significant influence on improvement in learner academic performance and their attitude in the mathematics subject. Furthermore, the said study supported the results of the present study since student's attitude in this particular topic may vary, which can have a positive or negative impact on their performances.

3. Factors that affect the students from learning the competencies in Mathematics

Table 3 includes the factors identified by the students that affect them in learning the competencies. The indicators in each factor are based on the reflections in the interview guide distributed to the students.

Table 3: Factors that affect the students from learning the competencies

Factors	
1. Student-related factors	1. Phoning and watching TV All day 2. Poor sleeping habits 3. Lack of focus when studying
2. Home-related factors	1. Doing Household Chores 2. Answering my sibling's module 3. Slow Internet Connection 4. Noisy Surrounding 5. Poor lighting and ventilation
3. Subject-related factors	1. Lack of educational resources 2. Lack of instructional supervision. 3. Difficulty in comprehending math problems. 4. Boredom caused by repetitive activities

It can be inferred from the table that there are several factors identified by the students that can affect them in learning the competencies in Mathematics. Student-related factors is one the factor mentioned that includes the using cellphone and watching all day, poor sleeping habits and lack of focus when studying.

Similarly, the students considered home related factors as another factor which includes the household chores obliged by their parents, assisting their sibling in answering the modules, slow internet connection, noisy surroundings, and poor lighting and ventilation.

Likewise, the students identified subject-related factors as additional factor which includes the lack of educational resources, lack of instructional supervision, difficulty in comprehending math problems and boredom caused by repetitive activities.

It shows in the table that student-related factors mean that focusing on the everyday use technologies affect student's capacity to learn the competencies of mathematical concepts. Nowadays, many students browsed the net to know what's new in their social media accounts and enjoy playing mobile games. This habitual activity tends to affect the usual sleeping habits and lessen their focus on studying.

Moreover, since students mostly lived in far-flang areas, most of them experienced slow internet connectivity which affect their understanding. Since their parents work all day in the rice field, there are obliged to do household chores and to look for their siblings and tasked to teach them in school activities.

The modular learning lessens face to face interaction which means that student-teacher can only interact with each other through social media platforms that is why students identify the lack of educational resources and instructional supervision as one of the factors. Because of the sudden change of the mode of delivery of instruction, students find it difficult to analyze and comprehend by themselves. The repetitive tasks allow

them to be lazy in answering the activities on the learning activity sheets.

Generally, there are many aspects which can affect the learning of competencies of the students it can be environmental, emotional, intellectual and psychological factors. These factors are reasons why there is a difficulty in understanding and acquiring the competencies needed in a Mathematical concept. Also, these will give students lack of confidence and focus to develop their skills.

It would imply that teachers must be very observant to know the deep reasons behind the difficulty of the students in understanding the concepts in Mathematics. They should limit the number of learning activities, modify tasks which are suited to all types of learners in order to cater all the needs and reduce anxieties to the subject matter and innovate teaching strategies to make learning fun and enjoyable. Teachers can do revisions on some modules which are not applicable to the learners' abilities.

The result is similar with the study of Ganal and Guiab (2014) found that the problems and difficulty of towards mastering learning competencies in Mathematics are categorized in personal problems, emotional problems, problems on teacher's instruction, problems with school adjustment, problems in adjusting to classmates and boardmates, and problems arising from over-extended schedule/workloads for practice in different competitions. As a result of their study students encountered personal problems relating to school expenses, lack of interest and negative attitude towards the subject. The emotional problems encountered are excessive stress in doing academic tasks and low self-esteem or not believing in one's capabilities. On problems relating to teacher's instruction, these are no effective motivation and introduction, and not creative enough to adapt his/her method to the learner's capability.

As to problems with school adjustment, the most frequent are difficulty in adjusting to life/role of a college student, and not doing the tasks well. The problems in adjusting to classmates/boardmates are how to be accepted by classmates and boardmates, and working effectively with different kinds of classmates. With regard to problems arising from over-extended schedule/workloads for practice in different competitions, the most common problems are too many academic tasks and projects assigned, and studying and reviewing too many subjects every day.

4. Proposed Lesson Exemplar

Rationale

Mathematics plays a vital role in educational system since it encourages logical reasoning, critical thinking and spatial thinking. Acquiring mathematical skills enables learners to be a community problem-solver and effective communicator in their daily social interaction. However, learners wherein competencies were not attained supply teachers the information to modify and design lessons which are suited on the target clientele. Thus, developing lesson exemplars may aid teachers.

Lesson Exemplars is a detailed description of the course of instructions or learning trajectories for teachers. It provides teachers the freedom to show their creative and innovative way in delivering lessons depending on the learners' needs and capableness. The succeeding pages shows the developed lesson exemplars in coordinate proof, equation of a circle, problems involving circles, permutation and combination.

General Objectives

To enhance teaching approaches and strategies of teachers to cater learners' difficulties through the use of developed lesson exemplars.

Specific Objectives

1. To modify teachers' instruction to ensure the alignment of activities in order to help learners to achieve least learned competencies.
2. To help teachers explore new methodologies on introducing the lesson in simpler way.

CONCLUSIONS

Based on the findings of the study, the researcher arrived at the following conclusions:

1. The students performed very satisfactorily in permutation and combination. However, they performed satisfactorily in coordinate proof, equation of circle, and problems involving circle.
2. The students have varied least learned competencies in the different topics included in mathematics. These are the least learned competencies: solving problems about circles, permutation and combination, proving theorems, finding equation of a circle, plotting of points and graphing circles.
3. Student-related factors, Home-related factors, and Subject-related factors are the factors identified by the students that affect them in learning the competencies.

4. A lesson plan exemplar was developed in order to address the least learned competencies by the students in Mathematics.

RECOMMENDATIONS

In the light of foregoing conclusions, the following recommendations were offered:

1. The teachers may attend seminars about modification of teaching strategies and instruction for them to be equipped with new skills which they can use to teach students effectively to enhance their interest for mathematics learning.
2. The teachers may conduct a remediation program or review classes to help students with the least mastered competencies in order to reduce mathematical misconception and anxiety for better acceptance and understanding on mathematical concepts.
3. The teachers may recommend a study guide plan to the students for monitoring everyday activities to limit and lessen their unnecessary activities which are insignificant to their studies.
4. The lesson plan exemplars may be submitted to the Division Office for possible adoption. If found feasible, may be implemented by other mathematics teachers.
5. Further study may be included that may include other grade level students and topics which are not included in the study. Also, the effectiveness of the lesson plan exemplars may be further studies.

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