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Teaching and Assessment Practices in Mathematics in the Spiral Progression of the K to 12 Curriculum

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***Abstract*–Teachers who use assessments to improve instruction and who give students opportunities to correct their mistakes also give them the opportunity to excel. Assessments are tailored to fit the bill of a specific need. Despite some claims that teaching and assessment practices neither improved nor affect the academic achievement of the students, it is very important to note that students will learn best if teachers used appropriate teaching and assessment practices. Improving the quality of teaching mathematics is an unrelenting issue for both researchers and practitioners. There is an increasing pressure to develop student learning opportunities in mathematics (Even & Ball, 2010). Based on the literature and studies, it is very apparent that people particularly teachers' use varied ways to learn new things in their everyday lives. Teachers should spend lots of their time in planning learning. Therefore, they should be properly guided in selecting teaching assessment practices that are appropriate and applicable in their environment for them to achieve their academic objectives.**

Keywords:- *teaching practices, assessment practices, student engagement, instructional improvement, reliability, validity.*

I. INTRODUCTION

Assessment is not the only criteria for change in education. Educational reform in the previous years has been unpredictable for most teachers and schools. Institutions reflect the general differences that have occurred in the society. Additionally, there seems to be no end to the development that schools is expected to keep up with. Teachers and administrators seem to be conflicted over counteracting demands. They are also struggling to maintain balance. They are expected to lead despite the unrest and uncertainty on organization, management, education content, methods and assessment. At the same time, they are also anticipated to be ahead in understanding human education and effectivity (Earl, 2014).

As assessors, instructors are required to understand the legal and ethical issues in the practice (Brookhart, 2011). A significant part of the period at school is dedicated to educational assessment-related activities. These play a critical role in forming student motivation and performance in academics. Educators have always known that their knowledge and beliefs bear a huge influence (Alkharusi, 2012). Therefore, they enthusiastically encourage and promote active learning which is to go beyond passively taking in information following a constructivist approach. This particularly tends to work well for adult learners. It is to bring life skills and learnings for interpretation and information (Karge et al., 2011).

To support this cause in mathematical reasoning, conceptual understanding, and discourse, the environment requires equal opportunities for students to use multiple resources to do and learn math. This is fundamentally focused on acknowledgement of the "repertoires of practices" that students bring to the classroom (Moschkovich, 2013).Teachers' practices and attitudes are also considered to be important for understanding and improvement of the process. Their techniques for dealing with personal and professional problems, as well as their general well-being, have an impact on how they may influence the learning environment and motivation of students. They also serve as mediators for job-related policies, such as changes in teacher education or professional development curriculum.

Researchers Parks and Bridges-Rhoads (2011) cited that the curriculums are highly scripted. This is in reference to the renewed focus on early childhood mathematics education. They are mostly focused on finishing organized work rather than actual engagement with the pupils. This indicates the overall lack of innovation. It has reduced opportunities for kids to absorb the subject. On the other hand, authors Suurtamm, Koch and Arden (2010), responds to the issue through an article on how educators can integrate new evaluation concepts into their old practices. This included the use of journals, observation, questioning, self-assessment and other unique forms of tests. These allowed them to effectively examine the students' thinking. They have also formed recommendations for improvement.

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Additionally, the supporting nature of teachers in the new method was also observed.However, it is just as important to acknowledge that not all instructors are conducive to this change in their practice. With this, it raises important issues on how teachers can be heartened and engaged to make improvement in their teaching and identify which types of learning activities need to be promoted.

II. LITERATURE REVIEW

A. Assessment Practices

Quizzes, exams, writing projects, and other assessments that teachers conduct on a regular basis in their classes are the greatest evaluations for guiding gains in student learning. Overall, educationalists have confidence in the results from these as they address the required goals. Plus, the outcome is fast and easy to interpret at an individual level. However, teachers still should change both their views and interpretation as an important element of the learning process for pupils.

Implementation on efforts using a Response to Intervention or RtI model is being widely used to improve reading instructions and at the same time to support learning in mathematics. This will include screening for struggling pupils, monitoring advances and gauging efficacy. This is supported by an article by Lembke, Hampton, and Beyers (2012) that looks into its relevance to mathematics through evidence-based interventions and recommendation. One more study suggests the utilization of digital technologies in an effort to incorporate new tools into teaching and learning. It also aims to comprehend the progress and determine how learning communities are molded by it. Meanwhile, we have to recognize that it is not entirely up to the instructors, institution or the system. We also have to consider that the availability of resources can vary conditional to the economic status and capability of the country or region (Hoyles, 2010).

In order to achieve certain goals, it must evolve into tasks that can assess all elements of mathematics ability, not just those that appear to be simpler (Hoogland and Tout, 2018). For example, evaluating pupils' arithmetic skills is easier than evaluating their problem-solving skills. They continue to rely on tests that primarily cover algorithmic tasks (Palm et al., 2011) Furthermore, certain matters are linked to more basic, underlying structures rather than to format or level. This particular set-up and purpose affect pupils based on their difference and on their outcomes (Suurtamm et al., 2016). All in all, any assessment must be corroborated to ensure that all readings from the findings are correct and acceptable for the intended usage. (Newton and Shaw, 2014). To be fair, all evaluations should take into consideration a variety of distinct and interconnected sources of individuality (Leder and Forgasz, 2018). This ensures high-quality formative and summative tests, including multiple methods. It also offers learners a wide a variety of opportunities to display their arithmetic skills (National Council of Teachers of Mathematics, 2016).

B. Teaching Spiral Progression

The K to 12 curriculum was implemented in the Philippines in 2012. It was through the "Enhanced Basic Education Act of 2013," officially known as Republic Act 10533. It officially launched the country's K–12 education system (The Official Gazette, 2013). As students go to the next grade level, the curriculum was introduced. The spiral progression method, which strives to enhance Science and Math instruction, is one of the frameworks of the K-12 Enhanced Basic Education Program. The improved basic education curriculum shall be governed by the spiral progression method throughout courses, as mandated by RA 10533 and supported by DepEd Order 31 s. 2012. It is organized in such a way that it builds on the same principles in each school level, rising in complexity from Kindergarten to Grade 10. It is given that teachers should also adapt to the new approach.

There are a few key features of the spiral curriculum based on Bruner's work. First, the learner is to revisit topics, themes or subjects numerous times throughout their education years. Next, the complexity of the topic should increase with each repetition. Finally, there should be a relationship maintained between the new and old learning when it comes to context. The main benefit is that information is strengthened and solidified, allowing a logical advancement from simple to complex concepts. Students are also urged to apply what they've learned so far to future course goals (Johnston, 2012). The curriculum is built around the idea of introducing knowledge to students at an early age and reinforcing it throughout their schooling. It is important to emphasize that the children should have an active participation in the learning process and interaction with the environment (Piaget, 1962). Additionally, complex subjects, according to Bruner (1960), may be introduced to novices provided they are presented in a way that makes sense to them. The inquiry skills, whereby the primary grade students were introduced to the process of "hands-on minds-on," stage in which the students want to explore and ask some questions about the environment, were the first component of the curriculum components. As the student progresses through the grades, he or she should be able to design and perform investigations that include defining and monitoring variables, collecting and organizing data, formulating theories or models, and making decisions based on sound judgment and rational reasoning (Tinapay et al.,2021). The creation of process skills that are appropriate for a student's grade level should focus on higher order thinking abilities that are also in line with the assessment strategies to be employed and the teaching-learning process (Tirol, 2021).

The spiral progression method adheres to a progressive kind of curriculum based on John Dewey's notion of an individual's complete learning processes.

ISSN No:-2456-2165

Rather than the traditional method of education, this approach emphasizes meaningful engagement in learning and involvement in classroom democracy. According to Dewey, students must be invested and that the curriculum needs to have a bearing on their life. He encourages learning by application and development of real-world life skills. He believes that these are crucial to the children's education. It is to acquire, apply, develop their skills, knowledge and understanding through increasingly challenging situations.

The framework aims to aid math teachers in constructing lessons, activities or projects that will target the developmental thinking skills and characters. There should be steadiness that gives sufficient difficulty and growth for apprentices in a familiar curricular (Mangali, 2019). It improves retention and encourages mastery of subjects and abilities (Resurreccion and Adanza, 2015). In the end, a rich extensiveness and depth of knowledge is achieved.

The implementation of the new curriculum has garnered various reactions from learners and instructors alike in the government sector (Cabansag, 2014). Supply of educational opportunities, the use and availability of technology and the cumulative difficulty of instructions has gathered opposing feedbacks. Furthermore, teachers have been under pressure to adopt these new procedures with extreme precision due to the unfamiliarity. The existence of planned modules and teaching materials, on the other hand, has provided some sort of motivation (Department of Science and Technology – Science Education Institute, 2011).

C. Teaching Mathematics

Mathematics is a type of logic. Mathematical thinking entails thinking logically, generating and testing hypotheses, making sense of events, and forming and justifying judgements, inferences, and conclusions. The main concern in traditional mathematics instruction is that day by day seems to be the same. The teacher demonstrates problem solving examples and then the students practice the method in class and through homework. Basically, what pupils have seen and heard is repeated by them with less focus on understanding. However, with the new program, it is done through studying repeatedly but with diverse deepening of complexity. Learning can only be genuinely successful if it has a favorable influence to the student. It is well understood that teaching methods have a significant impact on student achievement and can also make a difference in the classroom.

For example, before the implementation of the K to 12, math is educated into four areas: Integrated Math, Algebra, Geometry and Trigonometry which are taught in different year levels respectively, in high schools. However, with the adoption of the K–12 curriculum, each level now covers all four key topics with increasing difficulty each year. As new information is given in the next session, the spiral "spirals upwards," allowing for reinforcement (Cabansag, 2014). Teachers offer students with multiple opportunities to tackle challenging and fascinating issues in the classroom environment envisioned by NCTM (2016). They can read, write, and discuss math. It is also possible to formulate mathematical ideas and provide their own conclusions. Students can use demonstrations, drawings, and real-world objects

D. Teaching Practices and Methods

Effectiveness in teaching math does not rely on a pre-determined educational method. It involves a dynamic and a two-way interactive process in which learners participate in the process through answering questions, participating in discussion, explicitly describing and showing their techniques to their peers within the classroom. On the other hand, teachers must also have a diverse range of teaching techniques in order for the lesson to be successful.

a) Lecture Method.
Speech is used to transmit knowledge in this approach. This is the most significant and oldest one and had always remained a part of the traditional instruction. The teacher is the active participant and learners are usually at the receiving end. It is a teacher centered approach, also referred to as broken or interactive lectures (Miller CJ, et.al, 2013). This may be utilized not just to educate theoretical concepts, but also to provide training for complicated skills and procedures.

Because this approach does not need any actual effort, it can only be used to teach the fundamental principles of each unit found in mathematical textbooks. It may be used to teach sets, logarithms, algebra, matrices, statistics, geometry, and trigonometry, among other subjects. Mathematical problems cannot be solved by this method but instead can be explained in a clear manner.

b) Inductive Method
This is often referred to as the scientific process, in which we go from the known to the unknown, from the specific to the general, and from an example to a rule or formula. Learners are given with some comparable instances or problems linked to one domain in this induction approach. Then, by observing them, students attempt to construct a formula, rule, law, or principle. According to Marriam, (2017), it is the method of teaching a mathematical idea by first offering examples, then identifying instances that match to the phases of the concepts and principles presented. Pupils are taught to form generalizations through the use of this technique of learning.

Instead than solving mathematical problems, this technique is used to develop laws, principles, formulae, and procedures. As a result, it may be used to any discipline of mathematics. However, only algebra, matrices, and to a lesser extent geometry are

ISSN No:-2456-2165

involved in developing rules or formulae at the secondary level.

c) Deductive method
is entirely different from the previous one. This allows you to move from general to specific, as well as from a rule to an example. It is the process of constructing the topic, a hypothesis, and concludes with tasks or examples (Marriam, 2017). We may also use undefined words, defined terms, axioms, and postulates to establish a theorem in this teaching method. We can derive other propositions using the assistance of that theorem, as well as many instructions and principles (Baig, 2015). This approach is commonly used to address difficulties involving complex operations. They can be addressed by immediately using various types of already established rules, techniques, formulae, and principles. Sets, logarithms, algebra, matrices, variation, statistics, geometry, and trigonometry are just a few examples of problems that may be found in secondary school mathematics textbooks.

d) Heuristic method
is founded on a child's desire to learn something new on his own. As a result, it's also known as the discovery technique. (Bruner, 1966). Students are encouraged to create their own knowledge in order to arrive at a solution. The teacher only acts as a facilitator by asking relevant questions. It's sometimes referred to as guided exploration or planned teaching. Heuristic method is the most effective method in teaching mathematics for both primary and secondary student (Abonyi&Umeh, 2014).

It may also be used to teach all aspects of mathematics. It is beneficial when students are unable to answer difficulties relating to a certain subject and require assistance. Learners are encouraged to use deductive or problem-solving approaches to tackle the same issues once they have mastered various methods and formulae.

e) Analytic method
from the word itself, analyzes the problem first. It is done through breaking it up in little parts, and then move on to a solution. It's also known as the descriptive approach. It connects the component of the problem that is unknown to something that is already known or stated in the problem statement. Theorem should be viewed as teaching the analysis of ready-made reasoning, its reproduction, independent discovery of the fact, search and creation of proofs, as well as rejection of the suggested reasoning (Bakirov, 2016).Because of the discovery technique, only certain types of issues can be taught using this method, which requires us to prove anything. Such issues can only be found in the secondary school subjects of algebra, geometry, ratio, and proportion.

f) Synthetic method
This method is the complete opposite of the analytic one. It is the process of moving from the existing or known parts of a problem to the desired or unknown solution. Existing facts are applied to new contexts, and the synthesis of existing facts aids in the discovery of new facts (Baig, 2015).

This approach is straightforward and is guided by the analytic method. The analytic method's analysis process clarifies the fundamentals of any notion. Synthetic approach, on the other hand, is built on previously learned principles. As a result, mastering particular mathematical ideas using the analytic approach is required before using the synthetic method to answer problems more rapidly. When using this approach to solve a mathematical issue, learners are not required to offer a justification for each and every step.

Just like analytic method, this can be used for such items that needs to be proven. It is also used to find the unknown through the statement stated conditions. At the secondary level, they can be found in algebra, ratio and proportion (variation), and geometry courses.

g) Problem solving method
is an instructional procedure that improves reasoning ability in the learners. They will be able to discover information in this manner various applicable to their everyday life. It may allow students to create their own concepts about mathematics and take charge of their own learning (Ayaz, 2010). Bruner, (1970), one of the most well-known psychologists, also gave a top recommendation to this particular. Similarly, an investigation by Tchoshanov (2011) states that his study stemmed from an assumption on the relationship between teacher content knowledge and student achievement. The outcome surprisingly shows a trend in which the teacher can positively impact middle grades students' achievement in mathematics. However, it should be noted that traditional methods should not be completely disregarded. Rather, we should incorporate a mix of the new and old together to make new strategies. This system is used to tackle complex issues that cannot be solved with a single law or formula. Word problems are the most common type. Such issues can be encountered in algebra, trigonometry, ratio, and proportion units at the secondary level (variation).

ISSN No:-2456-2165

h) Laboratory method
necessitates major practical work. It is a process of "learning by doing" which requires different kinds of tools and equipment to perform. It involves drawing various forms, collecting geometrical figures' dimensions, and creating charts and graphs. Students can also take part in laboratory activities to learn through watching and calculating. They gain the right to make inferences and generalize various rules and formulae. In this technique, the educator's duty is to oversee the entire process and provide clear directions at each stage. It is known to produce a farm more superior results than the other methods as children learn best by doing not just by sitting and listening (Emaikwu , 2012).This is primarily utilized in real-life situations. It may also be utilized at the secondary level to prove or disprove set and trigonometric rules and theorems. The inductive approach is often employed to establish these laws and theorems, but the laboratory technique can also be utilized to pique the learners' interest.

i) *Project method.*
Similar to the laboratory method, this is likewise based on the "learning by doing" principle. Pupils are engaged in projects that will allow them to put their academic knowledge into practice and learn on the job. They will work in a natural setting, whether outside or inside the school's perimeter. Tasks may be assigned individually or into groups (Baig, 2015).

The method entails cooperative learning promoting the sharing of idea and knowledge. Students also gain motivation driven to finish the job. For the first time, John Dewey (1916) stressed social interaction among learners, and he added that this approach is not intended to teach a single mathematical idea. With the aid of various teaching methods, learners may acquire different areas of mathematics such as algebra, geometry, and trigonometry using the project approach.

E. Good Teaching Practices

In a normal mathematics lesson, exposition is generally done in the form of a question and answer format. Definitions and rules are generally the first things that the teacher introduces. Typically, students mostly quiet to be able to listen effectively. In this study, educators are encouraged to use practical activities and to present a concept, practical effort is required and start discussion among learners. Students are also allowed to work in small groups, discuss and present their varied approaches to problem-solving and correcting their errors amongst themselves

a) Hands-on Activities
Practical work is an effective teaching method because it allows students to uncover abstract links through tangible ways on their own. Through this process, the logical thinking is emphasized which promotes positive attitude. This could have very beneficial effects on the interest and learning of a child (Holstermann, 2010). This can be achieved by facilitating appropriate activities and processing of the results, especially for issues that are tough for students to grasp. They can also learn how to perform action research to see if the plan is indeed beneficial.

b) *Using Group work*
Working in groups does have its merits however limited. If the group size was very big, for example, it would be difficult to include all members of the group in the solution debate. It is recommended to have smaller groups of a large group of one. Another problem is that the best learner in each group has the tendency to single-handedly solve different solution while the rest of the learner just stood there watching. The learning is not present. The Those who would showcase the group's product were the most insistent in asking inquiries. While the other groups were still working, some groups were off-task and occasionally loud since they completed quickly. In the past years, three main issues have emerged. First, mathematics is a topic that the majority of pupils dislike nor do they are successful in this field. Second, a new way of thinking about how to learn mathematical abilities and concepts, as well as new hypotheses about how to effectively teach students Lastly, mathematics achievement in other countries is vastly superior due to their different teaching methods (Westwood, 2019).

Hence, if properly implemented, it is an excellent teaching technique to use small group work. Cooperative learning provides peer assistance and resource sharing in the Philippines, where class sizes are sometimes excessively large and resources are few.

c) Encouraging multiple solutions to problems.
The delicate balancing act of accommodating student answers that may differ from what the teacher anticipates. This helps students recognize that certain methods are superior to others, which is an excellent teaching technique. On the one hand, learners will gain the idea that they are capable of devising their own solution to a problem, no matter how crude or inelegant it may appear, which will boost their confidence. Moreover, with varied solutions, they may assess their qualities and

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determine which is superior to the others, as well as the factors that influenced their decision.

III. PROPOSED ACTION PLAN

- *System Procedures for Curriculum Enhancement to Improve and Align Teachers' Teaching, Assessment and Skills*

Rationale: In this section, proposed plan of action consisting of the improvement of the curriculum to enhanced teachers' teaching and assessment practices in different private schools was presented.The objectives are as follows: creating a well-structured curriculum to address the needs of students with varied abilities through assessment and activities; applying technology to develop better measures of mathematical competence; developing collaboratively a professional learning committees for instructional revision and improvement and creating a procedure of updating curriculum that will improve the teachers' teaching and assessment practices.

A curriculum guide is a structured document that outlines the goals, objectives, learning experiences, instructional resources and assessments that comprise a specific educational program. Moreover, it represents an articulation of what students should know and be able to do and supports teachers in knowing how to achieve these goals. It can provide ideas, suggestions and recommendations intended to help teachers to make informed decisions, or be more prescriptive and detailed specifying the content, activities, tasks, and materials to be used by teachers.

The curriculum will have served as guide and should not be viewed as the culmination of the curriculum development process, but rather as an essential step in the process of ongoing curriculum development and implementation. Thus, no guide will be perfect. No guide will ever be a finished product cast in stone. No guide will be free from criticism. However, to be effective, a guide must earn acceptance by teachers and must be considered educationally valid by parents and the community at large.

Ongoing revision of curricula, the further development of school practices, beliefs about the role of mathematics education, content, and teaching methods all contribute to further complexity. Correspondingly, assessment must be constantly adapted to new circumstances, such as increased heterogeneity in the classroom or new technological possibilities. We might see this as an intimidating task, or it might encourage the research community to continue to work on the improvement of the teaching and assessment practices in mathematics education.

IV. CONCLUSION

To help their students realize their goals, teachers should attend to their successes, but be alert to their setbacks, particularly when they pertain to creating and reinforcing student relationships. Additionally, teachers should look out for negative outcomes in their students' experiences, because this reinforces the students' thoughts about lack of success. This is all visible as it is, meaning therefore showing that educators must redefine what it means to be a student, to be successful, and making preparations to teach include multiple capacities. Likewise, communicating assessment result and grading and assessment performance are commonly affected by teachers' professional trainings.

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