SPIRAL PROGRESSION APPROACH IN TEACHING MATHEMATICS: ITS IMPLEMENTATION IN THE PUBLIC SECONDARY SCHOOL

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Abstract. The study aimed to evaluate the extent of implementation of spiral progression approach in teaching mathematics in the public secondary in the context of new normal. Quantitative was utilized in the conduct of the study. The quantitative descriptive research method was used to determine teachers understanding about spiral progression approach in terms of its background and content standards, to evaluate the extent of implementation of spiral progression approach in terms of lesson planning, instruction, assessment and teaching strategies, as well as to determine if there is a significant relationship between the two variables: teachers understanding and implementation of spiral progression approach. Percentage of the Correct response, Mean, Pearson r were used to determine teachers understanding and the extent of implementation of spiral progression approach. The findings of the study show that teachers moderately understood spiral progression approach. The extent of the implementation of SPA exceeded the expectations which results to a positive outcome of the feature of the curriculum. Findings revealed that there is a significant relationship between teachers understanding and the implementation of Spiral Progression Approach and Project ETISPA (Enhanced Teachers Implementation of Spiral Progression Approach) to be proposed as an extension project. To improve this study, there should be a promotion of advocacy that supports the sustainability and effectiveness of spiral progression approach, further orientation on the roles and responsibilities of teachers and school heads, and enrichment activities like benchmarking and brainstorming, wide dissemination, and implementation of the proposed programs.
Keywords: *content standards, lesson planning, instruction, assessment, teaching strategies*

Introduction

One of the requirements for a country's prosperity is human strength. The key technique for boosting human resources is education (Byrd, 2011). Education is a major engine in driving human success and one of the useful tools for eradicating gender bias and eliminating poverty, stability, and peace. As stated by Johnstone et al. (2020) that education is a building block in one society. It is one of the most important investments that governments can make to create successful, healthy and egalitarian societies. Education is not only a right but also a passport to human progress and country's development. People benefit from education both formal and informal, in terms of job opportunities, income, health, and poverty reduction. According to Middleton and Ziderman (1997), a sensible and successful investment in people's education is essential in building the human capital needed to end poverty. Addressing the learning crisis, lowering learning poverty, and helping students acquire the skills they need to achieve. In the Philippines, the educational system allocates the highest government fund among all agencies as stated in the 1987 Philippine Constitution, Article XIV, Section 5, Paragraph 5 "The State shall assign the highest budgetary priority to education and ensure that teaching will attract and retain its rightful share of the best available talents through adequate remuneration and other means of job satisfaction and fulfillment."

An educated citizenry is the bedrock of a true democracy since people have power, education allows ordinary people to make informed and well-considered decisions, such

as electing leaders, purchasing or selling products and services, proposing new ways and means to make things more efficient, and being mindful of their actions that harm their fellow citizens. Hence, prioritizing education makes perfect sense. In an article from Middleton and Ziderman (1997), they stated that the national governments and international development organizations must invest more in education systems, and the linkage between expenditure and learning and other human capital results must be strengthened. This seeks a community to develop schools and educational systems where people can get learnings through formal education. The Department of Education envisioned that every barangay should have at least one primary school and at least one high school for every municipality or city so that access to school in every community has a better delivery and learners can have a better academic performance if their home is near the school. This idea is parallel to the study of Peteros et al. (2022) that students' academic performance is related to the proximity of the school and home. To further invest and attain an educated community, the government vowed to universalize primary education and help minimize illiteracy through the Education for All (EFA) campaign. EFA is a ten-year international initiative commitment launched in Thailand and identified 6 key educational goals one of them is to increase and assures quality education in all areas so that everyone achieves and recognized a learning outcome, particularly in reading, mathematics, and life application (Goldstein, 2004). Moreover, EFA, or Education for All 2015 is a vision and comprehensive reform program aimed at improving access to quality basic education for all Filipinos by 2015. Giving education to all Filipinos created an alternative learning system to supplement formal education and better serve those in need. This requires not just the engagement of the Department of Education, but also the entire society.

It has been observed that public schools are among the resources that aid in promoting EFA since they provide an expense-free education that is critical for a country's progress (Byrd, 2011). However, the old curriculum, or RBEC places the educational sector in the Philippines to revise its curriculum to further Filipino learners. In a study performed by Enicola in 2018, a survey indicated that out of 79 nations, a Filipino student performed poorly in science and arithmetic and last in reading comprehension. According to this poll, the majority of those evaluated attended public schools. The difficulty arises from the fact that a large portion of Filipinos is unable to read or do simple mathematical operations. Also, our country is the only country in Southeast Asia that only has ten years of basic education to conform to international standards. The Department of Education (DepEd) accepted and alters the curriculum in to K–12 to increase the worldwide recognition of Filipino graduates and professions (Dizon et al., 2019). Improving quality education is a primary tool in the emergence of a skilled people is a modification or adjustment of the curriculum to make it more effective. All Asian nations, excluding the Philippines, have had a 13-year basic education for the previous 6 years, and to harmonize with other countries' education systems Philippine government signed a law addressing the nation's basic education, known as the Enhanced Basic Education Act of 2013. It is the Republic Act 10533, an act strengthening the Philippine basic education system's curriculum and expanding the number of years of basic education. This law made it permissible to establish and implement a new curriculum (K-12).

The Spiral Progression Approach (SPA) is one feature of the k-12 curriculum which was initially used by Jerome Bruner in his spiral model. The teaching of the mathematics discipline covered by the aforementioned curriculum includes SPA.

According to Davis (2007), the spiral progression approach's main principle is to gradually review each subject's topic throughout the course while increasing both the breadth and depth of the information. TPACK-technological knowledge, content knowledge, and pedagogical knowledge-required to learn the fundamentals that lead to a more advanced and complicated version of the fundamentals. According to Espique and Vera-Silva (2021), as subjects and skills are explored and solidified, this will build retention and improve mastery. This also allows learners to choose subjects and skills that are suited to their cognitive abilities and growth. The child-centered approach is another name for the spiral progression strategy (Tan et al., 2012). The new curriculum includes several activities in which students are required to engage in collaborative learning, outcome-based performance, and peer tutoring and congruence with the idea of Resurreccion and Adanza (2015) that a spiral progression method makes use of performance-based assessment or sometimes called authentic assessment requires application of the content knowledge to a real-world environment. It is the method through which a student's performance was assessed and measured. The students will have opportunities to socialize, think, share ideas, and communicate. In a spiral curriculum, many fundamental ideas are presented, and the learning process is cyclical. For an instance, if a student learns the basic numbers in numeracy and learns to count from 0 up to 9, precedingly, students can count to 50 until it reaches 100, and later learners start to write numbers in words. To be able to read numbers, students must see the letters of the alphabet and make their sounds. In this situation, the learner keeps returning to the original idea of the number beginning with zero and ending with nine. The process of recurrence is acknowledged in this remark. A woman teaching her 2-year-old kid to read the letters from A to Z is another example. The child's initial learning spiraled into a thorough understanding of the letters. It is a spiral in nature because new information is added to the core topic as the student progresses through the basic concepts of knowledge.

Veladat and Mohammadi (2011) view that the spiral progression method does not differ much from other approaches. To achieve the educational objective, it simply aims to stretch students' cognitive abilities through a variety of questions and responses. The spiral curriculum has its unique set of characteristics. The first is subject revisiting. In recent years, topics have been revisited. Learners revisit previous lessons and learn them in a new and more comprehensive approach, such as applying basic mathematical operations more thoroughly. The escalation of the topic matter comes next. The complexity level increases as the subject are explored more. This results in the student gaining more information and increasing their proficiency. The learner's past learning is then linked to new learning. Finally, the learners' competency improves. Students' achievement levels improve with each visit until they have mastered the topic matter (Davis, 2007). An adjustment made possible because of the revision of the curriculum in implementing instructional strategies using the spiral progression method as mentioned by Resurreccion and Adanza (2015). Lesson planning (a blueprint that assists teacher in planning the class); next is instruction: the teacher discusses the facts, concepts, and principles that the learner learns next. In terms of assessment (a technique the teacher uses to assess, gauge, track, and record the student's competence) and last is in terms of teaching strategies (the strategies of where the teacher uses in teaching specific competency). Those four mentioned above must be parallel and interconnected to each other. Those mentioned were the basic routinary activities of a teacher and have been observed by the school head as a basis in the conduct of class observation and

rating for teachers' performance. As mentioned by Resurreccion and Adanza (2015) as well as Gazette (2013) stated the approach allows learners to learn progressively the different branches of mathematics whereas, in the old curriculum, algebra are first thought in first year, geometry in second year high school, trigonometry in third year high school and statistics and probability in forth year high school. In the new curriculum framework, beginning in 2013, public schools are required to use a spiral progression strategy. As a result, junior high school mathematics classes implement the spiral curriculum. Numbers and number sense, measurement, geometry, patterns and algebra, and statistics and probability are the five content areas covered by the new curriculum. Throughout the academic year, these content areas were separated into quarters. The content area is more in-depth, although the same concepts are covered throughout the academic year. According to Corpuz (2014), the new curriculum develops not just vertical (rise in subject matter complexity), but also horizontally (a wider range of subject content). Hence, school heads are tasked to examine the necessary materials for the implementation and ensure that teachers have a plan and supervisory guide for implementing the new curriculum (K-12). School administrators are also tasked with supervising the implementation of the new curriculum.

In research from Resurreccion and Adanza (2015), other nations that have adopted the spiral progression strategy have stated that it is ineffective in meeting the needs of their students. This spiral curriculum was difficult for most math teachers since they are accustomed to dealing with only one mathematics subject throughout the year. This contrasts with the study findings by Abelardo et al. (2019) that there is an increase in teachers who are challenged in facing pedagogical knowledge of the subject. In the context of our country (Philippines), however, the DepEd regards spiral progression as a tool for addressing the current educational issues. Teachers' expertise and perspectives are critical in adopting the curriculum. If teachers do not have a thorough comprehension of the curriculum, spiral progression approach will not be properly implemented in the teaching and learning process. However, in March 2020, the Philippine educational system was once affected by the global pandemic brought by the Corona Virus (COVID-19). This virus according to the World Health Organization, SARS-CoV-2 virus causes the infectious sickness. Hence, a global lockdown was implemented, and schools were forced to close for months, learners learn in different modalities such as modular, online, or blended, and through this scheme, they still conform to the competencies in a curriculum guide. Many changes have been brought forth by the COVID-19 pandemic in various domains, including the country's education sector. Before the pandemic, learners, teachers, and school heads come to school at 7 am up to 5 pm learning in four corners of a classroom but because of the pandemic, the new trend of working and studying from home has left teachers with a skeletal working arrangement (Rahiem, 2021).

Due to COVID-19, which has created new challenges for the nation's present circumstances, worries about education in the Philippines have grown more serious. Distance learning techniques via the internet, radio, or television broadcasts were necessary as a response to the unforeseeable conditions brought about by the emergence of the global health crisis. According to Enicola (2021), a blended learning approach that includes distance learning was also implemented in October 2020. In an article from Nishan and Mohamed (2021), she stated that at least one good thing has come out of the pandemic: there is now a much higher understanding of the value of public education. The pandemic teaches parents and guardians the value of practicality where

most students transferred from private schools to public schools where the mode of delivery has been the same since the pandemic started from the traditional learning swift shift to distance learning. However, catering to all the competencies in a curriculum guide a challenge to all teachers and learners, curriculum experts craft a learning competency that can ease the challenges in learning and so The Most Essential Learning Competencies (MELCs) were created by the Department of Education (DepEd) to serve as the main guide for all schools in selecting and putting into practice learning delivery strategies that are suitable for the local context and diversity of learners while meeting the COVID-19 challenges (Department of Education, 2020). The COVID-19 outbreak caused the education industry to undergo a digital revolution, which created a barrier to the new educational scheme. This has resulted in significant modifications to the educational process for students and teachers (Jereb et al., 2022). Before the pandemic, teachers and school heads follows the curriculum guide as a basis for instruction and monitoring but because of the outbreak, MELC has been used. In terms of lesson planning, Daily Lesson Planning has been used before the pandemic and shifted to Weekly Home Learning Plan. In terms of Instruction, traditional face-to-face instruction changed to distance learning. In terms of assessment, online quizzes and activities were used in distance learning and public schools were not required to conduct a quarterly assessment. Indeed, the information thereof, enrichment and/or intervention programs are needed to strengthen teachers understanding about the spiral progression approach. In light of the New Normal, the purpose of this study is to evaluate the extent to which the spiral progression method of teaching mathematics is being used in public secondary schools. In terms of a lesson plan, instruction, assessment, and teaching methodologies, it typically seeks to understand how teachers evaluate and apply the spiral progression strategy in this new normal setup of education. The researcher also wants to identify the relationship between teachers' understanding of the spiral progression approach and its implementation.

Theoretical framework

The study is centered on Jerome Bruner's spiral curriculum model, as seen in *Figure 1*. The spiral curriculum is grounded on Jean Piaget's cognitive theory at its core. but was later advanced and studied by Jerome Bruner in 1960. Bruner's first assumption was that every topic could be cognitively taught to a kid at any developmental stage. In other words, if adequately constructed and presented, even the most comprehensive knowledge may be understood by very young children. As emphasized by Bruner that human cognitive development happened in the following stages, the enactive, iconic and symbolic stage. For instance, when teaching the concept of a fraction to a young learner, we cannot teach immediately that ½ in a formal manner, hence we teach it in a manner where learners will not surprise. So, following the stages of Bruner, we started from an enactive stage where bring the actual object to demonstrate the concept of fractions such as a cake. Then followed by the iconic stage, wherein the cake we can make it more formal so we can draw a rectangle from the board to further demonstrate the concept of ½ to a learner finally in the symbolic stage learners are now ready to understand the concept of ½ in a formal way (Ibañez, 2021). Children play an active role in learning at a rate that corresponds to their stage of cognitive development. Therefore, to improve the learning experience, teachers should concentrate on enhancing the method of presentation rather than the subject matter being covered.

Bruner believed that by organizing the presentation into three steps, both children and even adults could learn complex concepts.

Figure 1. *Spiral Curriculum Model.*

As mentioned by Johnston (2012), for a learner to learn better, they must acquire the necessary key features as enumerated by Bruner: (1) throughout the educational career, the student returns to a topic, theme, or subject multiple times; (2) with each visit, the topic or lesson becomes more sophisticated; and (3) new information is placed in context with existing knowledge and has a relationship with it. In elaborating on spiral curriculum ideas, Efland (1995) states that it is a hierarchal structure of cognitive processes in which early learning serves as a foundation for subsequent learning. Bruner thought that as children grew older, learners' understanding should be reviewed to broaden the learner's cognitive understanding and to better grasp the transition from basic to complex contexts, which he termed the spiral progression approach. Hilda Taba, a curriculum theorist, was also a major influence behind the development of the spiral progression technique, which emphasizes the repeating of fundamental concepts and abilities throughout the school year (Davis, 2007). Similarly, the spiral progression approach was described by Corpuz (2014) as continuous learning in which concepts are gradually presented from simple to sophisticated, with the complexity level growing from one grade level to the next. Resurreccion and Adanza (2015) emphasized that SPA possessed three main philosophies; constructivism, progressivism, and behaviorism. Steffe and Gale (1995) defined constructivism as a theory that constructs insights, and are dependent on previous information of learning. It is also a learning philosophy founded on the premise that one can construct one's living by reflecting on events. In a study performed by Liu and Matthews (2005), they stated that constructivism emerged as Vygotsky studied the interest of behaviorists and information-processing approaches as the primary metaphor for human learning.

In the context of mathematics, constructivism plays an important drive in the realization of the spiral progression approach in mathematics education, problem-solving should be emphasized in the teaching of mathematics, and students should be encouraged to come up with their ideas for different problems and this leads to an

interaction between the teacher and the learner (Troelstra and Van Dalen, 2014). A teacher's main duty is to encourage a collaborative problem-solving environment where students actively contribute to their own growth. Based on this concept, a teacher facilitates learning rather than the sole dispenser of knowledge. The teacher directs the activity to address and expand the existing ideas of the students, making sure that he or she is aware of them (Oliver, 2000). A learning philosophy known as constructivism encourages active learners to create their own knowledge. As people interact and reflect on what they already know, they develop their own perspectives and add new information (schemas). In the classroom, scaffolding as shown in *Figure 2*, modeling a skill, providing hints or cues, and adjusting material or activity are examples of successful teaching when the adult consistently modifies the amount of his or her help in response to the learners' level of performance. Bruner coined the term scaffolding, which is used by teachers. Teachers do this by planning activities such that they build on students' past knowledge and help them achieve the specific learning objective. The teacher initially demonstrates the technique while the learner watches. The teacher then lets the student do it, takes a step back, and provides guidance and criticism as needed (Koblin, 2021). On the other side, progressivism is a learning theory that advocates for students to get practical knowledge or learn through doing. The basic idea of progressive philosophy is an individual's active participation in his or her growth and development. This incorporates the concept of Rosseau (child-centered school) and is similar to the study of Resurreccion and Adanza (2015) that SPA is a child-centered approach. Mathematically speaking, progressivism plays when a teacher let his student learn the concept of measurement and allows his learner to have a direct experience of measuring for instance the length of the gymnasium, the height of the building, etc.

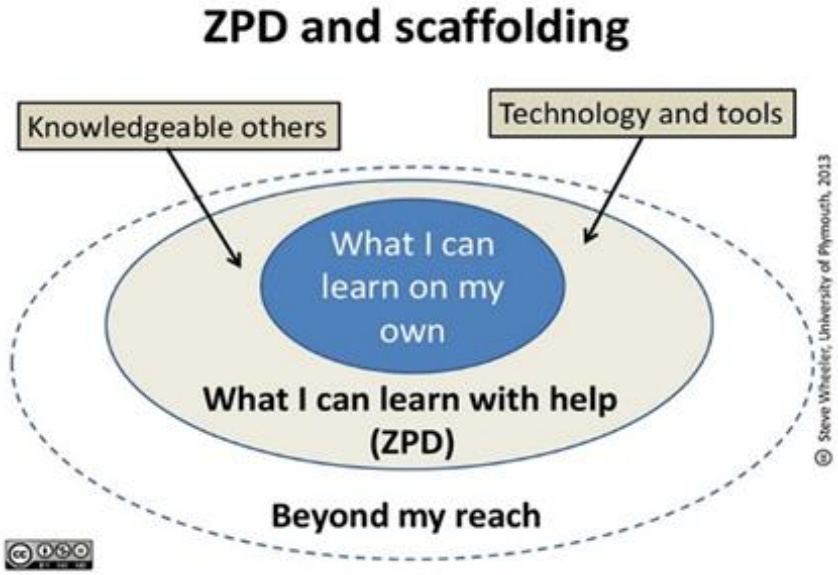

Figure 2. *Vygotsky's constructivist approach.*

The learning theory known as behaviorism, on the other hand, emphasizes behavior and then employs conditioning to change those behaviors. In other words, behaviorism centered on the learner's passive learning as a result of responding to external stimuli as presented in *Figure 3*. Behaviorism plays an important drive in mathematics where teachers tend to give remediated activities to the mathematics concepts that learners find

difficult like fractions and integers. The spiral progression approach places a strong emphasis on the necessity of continuity engaging with concepts to keep things active and relevant. There are three guiding ideas serve as its cornerstones: (1) cyclical learning; (2) increasing depth with each iteration; and (3) learning by building on existing knowledge, so the approach emphasizes the flexible aspect of learning. Hence, it serves as evidence that learning is a lifelong endeavor. As the learner advance to the next level, the content of the topic becomes wider and broader. Hence, a revisitation of the previously learned knowledge is very crucial in this type of curriculum. The Basic Education Program's need for quality improvement is urgent and crucial, according to the Department of Education (2010). As a result, the agency devised a plan to improve the nation's basic education program in the least disruptive, most practical for the government and families, and in accordance with international norms. In research, Dunton (2019) stated that the basic education curriculum in the Philippines is overcrowded. The curriculum, which was supposed to be completed in twelve years, was compressed to ten years, resulting in gaps in important skills among graduates, as well as a mismatch between industry demand and supply. The curriculum will be extended by two years to reduce congestion and this helps the realization of becoming internationally competitive through the execution of the reform among Filipino graduates in basic education.

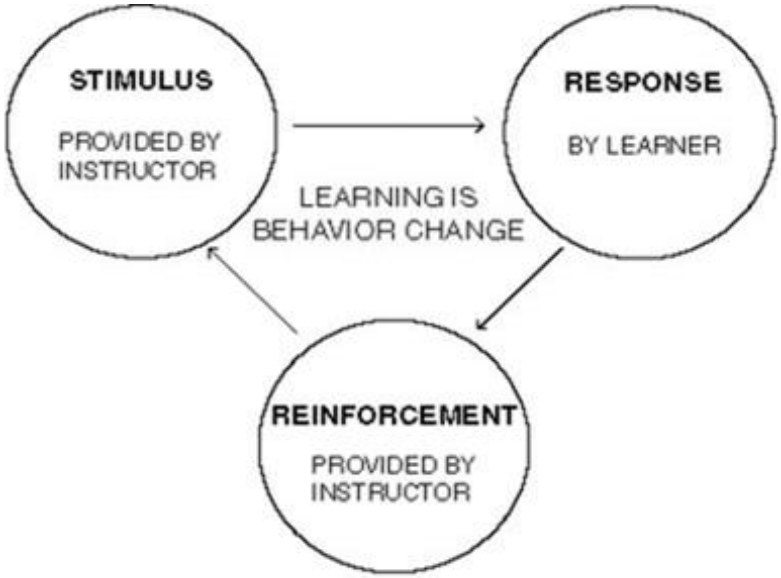

Figure 3. *Behaviorism model.*

In the context of education in Southeast Asian, Philippines is the only country with a ten year of basic schooling, whereas other country has 12-year basic education programs. As mentioned by Dunton (2019), the revised K-12 curriculum has been in use since the last school year 2011-2012. K-12 consists of kindergarten for one year, primary school for six, junior high school for four, and senior high school for two years. The spiral progression concept was included in the new K–12 curriculum that the Philippine educational system introduced. The Department of Education Order (DO) no. 31, series 2012, which is referenced in Section 5 of RA 10533, the Enhance Basic Education Act of 2013, states that the new curriculum uses a spiral progression strategy to ensure that all students in each school have mastered the necessary knowledge and

skills. The Grade one up to ten has a curriculum structured using the Spiral Progression Approach (SPA) throughout all subject areas. The curriculum was crafted by previewing ideas upon the established concepts and raising the standard for sophistication and complexity beginning in the primary grades. Since teachers are the curriculum implementors, they are expected to apply SPA in their teaching. Schools are expected to incorporate SPA as soon as K-12 is established. The mathematics framework in the enhanced basic education curriculum has been anchored in the theories mentioned above as presented in *Figure 4*. The basic education curriculum in the Philippines has experienced several adjustments over time. The main goal of the mathematics education according to its framework is-to promote critical thinking and problem-solving abilities in all learners-remain substantially the same across all levels, despite these extensive curricular alterations (Sandhu and Grover, 2017). The mathematics curriculum is being guided with a curriculum guide as part of the revisions made by the curriculum experts. The implementation of the aforementioned approach is significantly influenced by the mathematics curricular framework for the K-12 curriculum where learners are expected to grasp the necessary skills in mathematics to understand the wider range of the subject. Hence, students must remember the simple process to solve complex principles.

Figure 4. *K-12 Mathematics curriculum framework.*

Mathematics is seen as an indispensable instrument for educated engagement in a technological society. NISMED (2001) mentioned that as the degree of mathematics required in the workplace, its study is becoming increasingly important in the development of a "scientifically and technologically educated citizenry." As a result, the approval of the new curriculum suggests a significant effort toward national transformation, economic advancement, and human growth. With this strategy integrated in K-12 implemented in the Philippine educational system, it is anticipated that the mathematics curriculum would have a comprehensive foundation (Gazette,

2013), because a country's economic success is primarily reliant on advances in science and technology, and a solid foundation in mathematics.

Research questions

In the research questions, (1) what is the understanding of teachers in the spiral progression approach in terms of the following: (a) basic tenets; and (b) content standards? (2) What is the extent of the implementation of of the spiral progression approach along the: (a) lesson plan; (b) instruction; (c) assessment; and (d) teaching strategies? (3) What is the relationship between a teachers understanding of the spiral progression approach and its implementation?

Materials and Methods

Quantitative Research Design was used in this study. This study used a survey-questionnaire to collect, analyze, and integrate quantitative data in order to evaluate the extent of the implementation of the spiral progression approach in teaching mathematics along with lesson planning, instruction, assessment, and teaching strategies and the relationship between the teachers' understanding of the spiral progression approach and its implementation.

Research instruments

The survey-questionnaire used in the study was adopted from Resurreccion and Adanza (2015), but modifications were made. The said questionnaire banked on the extent of teachers understanding and implementation. The questionnaire for problem 1 is a binary question as to basic tenets of Spiral Progression Approach where respondents are to choose two options (True or False) and as to content standards , the questionnaire was taken from the DEPED Curriculum Guide version 2016 and it is a multiple-type question assessing the teacher's understanding of the spiral progression approach as to content standards where respondents are to choose what appropriate grade level the following content standard belongs. The questionnaire for problem 2 is based on an arbitrary scale getting insights about the extent of the implementation of the Spiral Progression Approach along with lesson planning, instruction, assessment, and teaching strategy. The questionnaire underwent reliability testing to verify that the instrument would accurately measure what it is intended to measure. The instrument's internal consistency was examined using Cronbach's Alpha by the researcher. The tool was pilot test for the 2019 PNU-NL batch of bachelor's in mathematics education. The instrument's Cronbach Alpha using SPSS, Microsoft Word, and Excel is 0.73. So, on George and Mallery (2021) scale (>.9: Excellent; >.8: Good; >.7: Acceptable; >.6: Questionable; >.5: Poor; and .5: Unacceptable), the instrument is acceptable.

Statistical treatment

Statistical Package for Social Science was used to record, classify, tabulate, and analyze the data collected from respondents via the questionnaire (SPSS). For problem 1, the percentage of the correct response was used to determine the extent of understanding of the respondents in the spiral progression approach as to its background and content standard. The scale of interpretation is hereby lifted as followed (*Table 1*). A four-point type Likert scale was also employed to arrive at a specific interpretation of

(quantitative) data. The scale of interpretation is hereby lifted as followed (*Table 2*). The frequency count, percentage and mean were computed to determine the extent of the implementation of spiral progression approach in teaching mathematics. For problem 3, The significant relationship between the teacher's understanding of the spiral progression approach and its implementation was determined using Pearson.

Table 1. *Scoring and interpretation on teachers understanding of spiral progression approach.*

Extent of teachers understanding		
Grade range (in %)	Achievement level	Summary description
80-100	Level 5	A very high to the outstanding level of achievement (VH)
70-79	Level 4	A high level of achievement (H)
60-69	Level 3	A moderate level of achievement (M)
50-59	Level 2	A passable level of achievement (P)
Below 50	Level 1	Insufficient achievement of curriculum expectation (I)

Table 2. *Scoring and interpretation on teachers extent of implementation of spiral progression approach.*

Extent of teachers' implementation of spiral progression approach	
Scale	Qualitative description
1.00-1.75	Unsatisfactory: Performance is unsatisfactory because it falls short of the standards for the role (U).
1.76-2.50	Area of concern: Performance has to be raised from its current barely acceptable level (A).
2.51-3.25	Meet expectations: Performance that consistently satisfies all criteria (M).
3.26-4.00	Exceed expectation: Performance beyond average; going above what is required for the posiion comparable to the finest (E).

Results and Discussion

Quantitative data analysis on teacher's understanding and implementation of the Spiral Progression Approach in teaching Mathematics

The information in the following tables shows the mean levels of teachers' understanding on the basic tenets of spiral progression approach's and its implementation. Also, it shows the connection between the study's two variables. Since teachers are used to teaching just one Mathematical subject for the entire year, the majority of Mathematics teachers found it difficult to apply this spiral progression approach. Teachers are required to teach the five content areas of the K-12 Mathematics curriculum for a whole academic year. The government also urges Math teachers to modernize their instructional strategies and incorporate cutting-edge technology into their classes (Ibañez et al., 2021).

Teachers' understanding of the Spiral Progression Approach

Nasic tenets

Table 3 reflects the extent of teachers understanding of the spiral progression approach in terms of its basic tenets. Among the twenty-indicator provided, teachers understanding of spiral progression approach as to basic tenets has an overall mean of 69.83% to a moderate understanding. Results shows that indicator 20 or More in-depth information is delivered in a spiral progression approach (96.67%) has the highest correct percentage. This can be attributed to the teacher's routine activity that before presenting the new topic, teachers must connect and review the previous topic to build the connection between the previous and new lesson (Rawlings Lester et al., 2017). Contrary, indicator 18 or the spiral progression approach introduced in a sequential

approach (30.00%) has the lowest percentage. It can be linked to teachers' old habit of teaching Algebra in the first year of high school, Geometry in the second year of high school, Trigonometry in the third year of high school, and Statistics and Probability in the fourth year of high school (Resurreccion and Adanza, 2015).

Table 3. *Teachers' understanding of the spiral progression approach as to its basic tenets*.

	Indicators	Expected response	f	%	Remarks
1	Spiral progression approach avoid disjunction between stages of schooling.	True	27	90.00	Very high
2	Spiral progression approach promotes sufficient review once units are completed.	False	11	36.67	Insuffieicnt
3	Spiral progression approach allows learners to learn topic and skills appropriate to their development/cognitive stages.	True	27	90.00	Very hugh
4	The rate of introducing new concept is often either too fast or too slow in spiral progression approach.	False	17	56.67	Passable
5	Spiral progression approach allows learners to learn topics and skills as they are revisited and consolidated.	True	27	90.00	Very high
6	All concepts are allotted the same amount of time whether they are easy or difficult to master in spiral progression approach.	False	17	56.67	Passable
7	Spiral progression approach strengthens retention and mastery of topics and skills as they revisited and consolidated.	True	24	80.00	Very hugh
8	Spiral progression approach is difficult to sequence instruction in ensuring students acquire necessary pre-skills before introducing difficult skills	False	16	53.33	Passable
9	Spiral progression approach is the sequencing of subject contents from simple to complex.	True	25	83.33	Very high
10	Subject content in this approach is being revisited repeatedly across grades in spiral progression approach.	True	22	73.33	High
11	Spiral progression approach limits the teacher to discuss his/her lesson.	False	13	43.33	Insufficient
12	As the concept of the subject is revisited, learning is extended, reinforced, and broadened in spiral progression approach.	True	25	83.33	Very high
13	Spiral progression approach enables students to connect disciplines.	True	27	90.00	Very high
14	Teacher's voice is the sole dispenser of information in spiral progression approach.	False	13	43.33	Insufficient
15	Student's understanding about the subject is widened slowly and steadily in spiral progression approach.	True	10	33.33	Insufficient
16	Spiral progression approach ensures vertical articulation and seamless progression of competencies.	True	26	86.67	Very high

17	Teaching of topics in spiral progression approach from more than one discipline in parallel to the other, where one discipline is crossed with the subject matter of another	True	28	93.33	Very high
18	Spiral progression approach introduced in a sequential approach where Elementary Algebra is taught in grade 7, Intermediate Algebra in the grade 8 and Geometry in grade 9.	False	9	30.00	Insufficient
19	Spiral progression approach is spontaneous and self-directed exploration.	True	26	86.67	Very high
20	Each time the concept of this is repeated, more in-depth knowledge is presented in spiral progression approach so that each successive encounter of the concept builds on the previous one.	True	29	96.67	Very high
	Overall			69.83	Moderate

Content standards

The teacher's understanding of the spiral progression approach to content standards is presented in *Table 4*. As shown in the table, majority of the teachers are above average when it comes to their understanding of the DepEd K-12 curriculum content standards. This resulted in an overall mean of 61.78% or a Moderate level of achievement. The result can be associated with a poor understanding of the teachers' Mathematics curriculum framework. According to the data, mastery of the subject may influence teachers' understanding of the spiral progression approach with regard to content standards. This finding is consistent with Smithers and Robinson's study from 2005, which found that mastery of the subject's content standards plays a crucial role in teachers' understanding of the subject's organization and concept sequencing. An adverse reaction in cost to learning transfer will lead to a lack of topic competence and quality of teaching the subject.

Table 4*. Teachers' understanding of the spiral progression approach as to its content standards.*

	Indicators	Expected response	f	%	Remarks
1	Factors of polynomials, rational algebraic expressions, linear equations and inequalities in two variables, systems of linear equations and inequalities in two variables and linear functions	Grade 8	23	76.67	High
2	Variation and radicals	Grade 9	24	80.00	Very High
3	Combinatorics and probability.	Grade 10	25	83.33	Very High
4	Sets and the real number system.	Grade 7	28	93.33	Very High
5	Measures of position	Grade 10	24	80.00	Very High
6	Circles and coordinate geometry.	Grade 10	18	60.00	Moderate
7	Algebraic expressions, the properties of real numbers as applied in linear equations, and inequalities in one variable.	Grade 7	17	56.67	Passable
8	Linear inequalities in two variables, systems of linear inequalities in two variables and	Grade 8	21	70.00	High

	linear functions.				
9	Inequalities in a triangle, and parallel and perpendicular lines.	Grade 8	18	60.00	Moderate
10	Logic and reasoning.	Grade 9	6	20.00	Insufficient
11	Parallelograms and triangle similarity	Grade 9	17	56.67	Passable
12	Sequences, polynomials and polynomial equations.	Grade 9	13	43.33	Insufficient
13	Statistics, data collection/gathering and the different forms of data representation, measures of central tendency, measures of variability, and probability.	Grade 7	13	43.33	Insufficient
14	Quadratic equations, inequalities and functions, and rational algebraic equations	Grade 9	19	63.33	Moderate
15	Geometry of shapes and sizes, and geometric relationships.	Grade 7	12	40.00	Insufficient
	Overall			61.78	Moderate

Extent of teachers' implementation of the Spiral Progression Approach

Lesson planning

The extent of the implementation of the spiral progression approach in terms of lesson planning is presented in *Table 5*. Among the ten indicators, teachers implement all to a exceed expectation. Results shows that the overall mean was 3.55 which shows 'exceed expectation' in the extent of implementation of lesson planning in the spiral progression approach. It can be seen in the data that indicator number 1 or Topics for Weekly Home Learning Plan (WHLP) based on the Most Essential Learning Competency (MELC) for the week has the highest mean (3.93) which outranks the other indicator followed by indicator number 5 or Before the respondents make WHLP, the respondents review previous lessons to ensure that their students are capable of meeting their goals (3.77) has the second highest mean. Indicator number 4 or In terms of breadth and depth of my WHLP, respondents design learning outcomes that allow their students to absorb more facts and principles (3.53), and indicator number 10, or the respondents design their lessons constructively so that my students can have a deeper and broader understanding (3.53) has the third highest mean. It was followed by indicator number 7 or the respondents make linkages between my instruction, assessment, and teaching strategies to help learners receive lasting information (3.50), indicator number 8, or When planning lessons, the respondents make sure that students may review previously learned topics with increasing levels of complexity and indicator number 9 or To relate all topics in the MELC, the respondents design WHLP using a variety of strategies have the same mean of 3.47. The respondents create a WHLP based on their students' past assessment scores or indicator 2, indicator 3 or the respondents make WHLP by recalling previous teachings and relating them to the current one and indicator number 6 or they plan activities based on the amount of progress or proficiency required by the MELC have the lowest mean of 3.43.

Table 5*. The extent of the implementation of the spiral progression approach in terms of lesson planning.*

	Lesson planning	Mean	Description
1	Topics for Weekly Home Learning Plan (WHLP) are based on the Most Essential Learning Competency	3.93	Exceed expectation

	(MELC) for the week.		
2	I create a WHLP based on my students' past assessment scores.	3.43	Exceed expectation
3	I make WHLP by recalling previous teachings and relating them to the current ones.	3.43	Exceed expectation
4	In terms of the breadth and depth of my WHLP, I design learning outcomes that allow my students to absorb more facts and principles.	3.53	Exceed expectation
5	Before I make my WHLP, I review previous lessons to ensure that my students are capable of meeting my goals.	3.77	Exceed expectation
6	I plan activities based on the amount of progress or proficiency required by the MELC.	3.43	Exceed expectation
7	I make linkages between my instruction, assessment, and teaching strategies to help learners receive lasting information.	3.50	Exceed expectation
8	When planning lessons, I make sure that students may review previously learned topics with increasing levels of complexity.	3.47	Exceed expectation
9	To relate all topics in the MELC, I design my WHLP using a variety of strategies.	3.47	Exceed expectation
10	I design my lessons constructively so that my students can have a deeper and broader understanding.	3.53	Exceed expectation
	Overall	3.55	Exceed expectation

Instruction

The mean of the indicators of the extent of implementation of the spiral progression approach in terms of instruction is presented in *Table 6*. Among the ten indicators, nine of it were implemented by teachers to exceed expectation and only one was implement to 'meet expectation'. Results shows that the overall of the extent of implementation of the spiral progression approach in terms of instruction ‘exceed expectation’ (3.46). If students did not fully understand the prerequisite skill, the respondents reteach by incorporating the new skill or indicator 4 has the highest mean of 3.63 (exceed expectation). Indicator number 3 or during online classes, the respondents review past skills before moving on to the current skill has the second highest mean of 3.60 (exceed expectation). Indicator number 2 or the respondents ensure that the self-learning modules (SLM) for the students follow the spiral strategy and indicator number 5 or adding additional materials to supplement the SLM has the third highest mean of 3.53 (exceed expectation). The respondents incorporate spiraling in my daily instruction (indicator 1), provide multiple platforms to teach the necessary skills needed in the competency (indicator number 8), amplify their message with large group discussions, and give at least five minutes of spiral review (indicator number 9), and teach concepts having multiple learning experiences (indicator number 10) have the fourth highest mean of 3.47 (exceed expectation) followed by indicator number 6 or the respondents choose a game-based instruction that reviews a previously taught concept garnered a mean of 3.27 (exceed expectation) and indicator number 7 or reteaching the skills taught in an online class to face-to-face instruction has the lowest mean of 3.20 (meet expectation).

Table 6*. The extent of implementation of the spiral progression approach in terms of instruction.*

	Instruction	Mean	Description
1	I incorporate spiraling in my daily instruction.	3.47	Exceed expectation
2	I ensure that the self-learning modules (SLM) for the students follow the spiral strategy.	3.53	Exceed expectation
3	During online classes, I review a past skills before moving on to the current skill.	3.60	Exceed expectation
4	If students did not fully understand the prerequisite skill, I reteach by incorporating the new skill.	3.63	Exceed expectation
5	I add additional materials to supplement the SLM.	3.53	Exceed expectation
6	I choose game- based instruction that review a previously taught concept.	3.27	Exceed expectation
7	I reteach the skills taught in online class to face-to-face instruction.	3.20	Meet expectation
8	I provide multiple platforms to teach the necessary skills needed in the competency.	3.47	Exceed expectation
9	I use big group discussion to reinforce my lesson and I also provide at least five minutes spiral review.	3.47	Exceed expectation
10	I teach concepts having a multiple learning experience.	3.47	Exceed expectation
	Overall	3.46	Exceed expectation

Assessment

Table 7 displays the extent of implementation of the spiral progression approach in terms of assessment. Among the ten indicators, nine of it were implemented by teachers to exceed expectation and only one was implement to 'meet expectation'. Results shows that the overall of the extent of implementation of the spiral progression approach in terms of assessment ‘exceed expectation’ is 3.56. The table reveals that indicator number 8 or the respondents based their evaluation on their students' most recent comprehension has the highest mean of 3.80 (exceed expectation). In order to organize their upcoming class, math teachers used the results from assessments or indicator 10 has the second highest mean of 3.77 (exceed expectation) followed by indicator 1 or the respondents sought for a comprehensive evaluation of students' knowledge and abilities while empowering them to take ownership of the process and utilize homework as a chance to put newly learned skills into practice (indicator 9) have the third highest mean of 3.70 (exceed expectation). The respondents facilitate assessment in developing learners' higher-order thinking and 21st-century skill or indicator 6 garnered a mean of 3.63(exceed expectation) followed by compare the result of assessment done online and face-to-face or indicator 4 has a mean of 3.57(exceed expectation). Indicator number 2 or I use different assessment tools in determining students' level of competency (Google Form) has a mean of 3.53 indicator number 2 or I use different assessment tools in determining students' level of competency (Google Form) (indicator 5) followed by indicator 5 or provide additional assessment aside from the tool given in the has a mean of 3.33 indicator number 2 or I use different assessment tools in determining students' level of competency (Google Form) (indicator 5). Indicator 6 or the respondents detached the answer key of the SLM to assess students understanding has a mean of

3.30 (exceed expectation) and indicator number 3 or administering an assessment in a face-to-face setup has the lowest mean of 3.23 (meet expectation).

***Table 7**. The extent of the implementation of the spiral progression approach in term of assessment.*

	Assessment	Mean	Description
1	I aim for a holistic assessment in measuring my student's current understanding and developing abilities while enabling them to make responsibility in the process.	3.70	Exceed expectation
2	I use different assessment tool in determining students' level of competency. (Google Form)	3.53	Exceed expectation
3	I only administer an assessment in a face- to- face set up.	3.23	Meet expectation
4	I compare the result of assessment done thru online and face- to- face.	3.57	Exceed expectation
5	I provide additional assessment aside from the tool given in the SLM.	3.33	Exceed expectation
6	I detach the answer key of the SLM to assess students understanding.	3.30	Exceed expectation
7	I facilitate assessment in developing learners higher order thinking and 21st century skills.	3.63	Exceed expectation
8	I will utilize my student's current understanding as basis of my assessment.	3.80	Exceed expectation
9	I use homework as an opportunity to have my students practice skills they have already learned.	3.70	Exceed expectation
10	I use the data from my assessment to help me plan my next lesson.	3.77	Exceed expectation
	Overall	3.56	Exceed expectation

Teaching strategy

It can be reflected in *Table 8* the extent of the implementation of the spiral progression approach in terms of teaching strategies. Among the five indicators, two of it were implemented by teachers to exceed expectation, two was implement to 'meet expectation' and the other one was implemented to an area of concern. The result shows that the overall of the extent of implementation of the spiral progression approach in terms of teaching strategy 'meet expectation' is 3.07 The table portrays that indicator 4 or "cooperative learning" has the highest means of 3.60 (exceed expectation) followed by indicator number 2 or "collaborative learning" has the second highest mean of 3.43(exceed expectation). Indicator 1 or "discovery/ inquiry learning" garnered a mean of 3.20 (meet expectation), followed by indicator 3 or "experiential learning" with a mean of 2.73 (meet expectation). Lastly, indicator 5, or "jigsaw puzzle" has the lowest mean of 2.40 (area of concern).

***Table 8**. The extent of the implementation of the spiral progression approach in terms of teaching strategies.*

Teaching strategies	Mean	Description
Discovery/inquiry learning	3.20	Meet expectation
Collaborative learning	3.43	Exceed expectation

Experiential learning	2.73	Meet expectation
Cooperative learning	3.60	Exceed expectation
Jigsaw learning	2.40	Area of concern
Overall	3.07	Meet expectation

The significant relationship between teachers' understanding and implementation of the Spiral Progression Approach

In *Table 9*, the correlation analysis presents that the Pearson Correlation coefficient between the teacher's understanding and implementation of the Spiral Progression Approach is .454, and the p-value is .006. The correlation coefficient is significant at a .01 level of significance. Since the p-value is less than .05, we reject the null hypothesis stating there is no significant relationship between the teacher's understanding and implementation of the Spiral Progression Approach. The result showed that teachers understanding and implementation of the Spiral Progression Approach have a significant relationship. It indicates that teachers who understand very well the background of the said approach and its content standard of the mathematics curriculum guide are also performing their roles and responsibilities in the implementation of the Spiral Progression Approach. The findings of this study dovetail with the study of Resureccion and Adanza (2015), the author concluded that teachers are actively engaged in the implementation of the spiral progression approach with the technical support of the school heads in the realization of instructional goals of the curriculum. It implies that once Spiral Progression Approach is fully embraced and well-implemented, teachers together with the school head will produce competitive learners with problem-solving and critical skills as the primary goal of the k-12 curriculum.

Table 9. *Pearson correlation between teachers' understanding and implementation of spiral progression approach.*

		Pearson correlation	N	Sig. (2-tailed)
Understanding of the spiral progression approach	Implementation of spiral progression approach	.454**	35	.006

*Notes: ** means correlation is significant at the 0.01 level (2-tailed).*

Conclusion

The purpose of this study was to evaluate the extent of implementation of spiral progression approach in teaching mathematics. The following conclusions were formed as a result of the findings: (1) teachers in the Department of Education are on the level where mathematics teachers engage in a very minimal accomplishment. As a result, teachers are finding it difficult to adjust to the new strategy; (2) the extent of implementation of the spiral progression approach is collaboratively developed by teachers and school heads. It implies that teachers grasp a vertical articulation and grasp the necessary skills in implementing the approach; and (3) there is a significant relationship between teachers' understanding and implementation of the spiral progression approach. So, if teachers have a high understanding of the approach rest assured of the realization of instructional goals and objectives, better delivery of instruction, and smooth transition of transferring of learning.

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Conflict of interest

The authors confirm that there is no conflict of interest with any parties involved with the study.

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