April 2021

Curriculum Continuity and Progression in Teaching Junior High School Mathematics

Judy Vargas Bongala
Philippine Normal University

CURRICULUM CONTINUITY AND PROGRESSION IN TEACHING JUNIOR HIGH SCHOOL MATHEMATICS

A Thesis Paper Presented to the
Faculty of College of Graduate Studies and Teacher Education Research
Philippine Normal University

In Partial Fulfillment of the Requirements for the Degree
Master of Arts in Mathematics Education
with Specialization in Secondary School Teaching

JUDY VARGAS BONGALA
April 2021

APPROVAL SHEET

This thesis entitled **"CURRICULUM CONTINUITY AND PROGRESSION IN TEACHING JUNIOR HIGH SCHOOL MATHEMATICS"** prepared and submitted by **JUDY VARGAS BONGALA** in partial fulfillment of the requirements for the degree of Master of Arts in Mathematics Education with specialization in Secondary School Teaching, is hereby recommended for approval and acceptance.

ROSIE L. CONDE, Ph.D.
Adviser

Approved in partial fulfillment of the requirements for the degree of Master of Arts in Mathematics Education with specialization in Secondary School Teaching **by the Oral Examination Committee.**

ARLYNE C. MARASIGAN, Ph.D.
Chairperson

ERMINDA C. FORTES, Ph.D.
Member

LEVI E. ELIPANE, Ph.D.
Member

Accepted in partial fulfillment of the requirements for the degree Master of Arts in Mathematics Education with specialization in Secondary School Teaching.

25 March 2021
Date

ANTRIMAN V. ORLEANS, Ph.D.
Dean
College of Graduate Studies and Teacher Education Research

ACKNOWLEDGEMENT

"Let perseverance finish its work that you may be mature and complete,
not lacking anything."
James 1:4

Writing this paper was never fast and easy. Indeed, it is by God's grace and the perseverance He wanted me to gain throughout the process that led me to finally attain this achievement. My earnest gratitude to the people who helped me become mature and complete, not lacking anything in this study.

To my thesis adviser, **Dr. Rosie L. Conde**, I am blessed to be your advisee. Thank you for the guidance, immediate feedbacks and encouragements. I learned so much from you. When time comes that I will become a thesis adviser too, I will remember and emulate your passion and professionalism.

To my panel members, **Dr. Erminda C. Fortes**, **Dr. Levi E. Elipane,** and **Dr. Arlyne C. Marasigan**, thank you for giving direction to my study. Your wisdom are exceptional!

To PNU professors, **Dr. Adonis P. David**, **Dr. Rene R. Belecina**, **Dr. Crist John M. Pastor**, **Dr. Wilma S. Reyes**, **Dr. Ma. Jenina N. Nalipay**, **Dr. Celina P. Sarmiento,** and **Dr. Evangeline F. Golla**, thank you for unselfishly imparting your knowledge and involving us in research works.

To my instrument validators, **Dr. Teresita T. Rungduin**, **Dr. Heidi B. Macahilig,** and **Dr. Merry Ruth M. Gutierrez**, who also served as my language editor, sincere thanks for your invaluable time and contribution in validating my research instruments. Likewise, my appreciation to **Dr. Bill Atweh**, **Dr. Teresita T. Rungduin,** and **Dr. Praksis A. Miranda**, for validating and refining my recommendations.

To the **Graduate Research Office**, headed by Dr. Arlyne C. Marasigan and Dr. Adonis P. David, the current and former GResO Directors, respectively, thank you for guiding me in my thesis writing process and for allowing me to use the GResO laboratory. To Sir Nathan Dalida, thank you for your commitment and assistance.

To my benefactor, **Department of Science and Technology – Capacity Building Program in Science and Mathematics Education (DOST-CBPSME)** headed by Dr. Josette T. Biyo, thank you for the privileges and financial assistance. I will always remember that I am a scholar for the nation.

To **Dr. Eden V. Evangelista** and **Dr. Crist John M. Pastor**, the former and current PNU-DOST Project Directors, respectively, and to **Ms. Mary Jean A. Morante**, the Scholarship Coordinator, thank you for your service to PNU DOST scholars.

To **PNU DOST-CBPSME co-scholars and colleagues**, Vanessa, Paul, Albert, Sarah, Kuya Martin, Ate Jerica, Ate Pearl, Ate Way, Ivan, Novek, Noel and Kuya Tristan, thank you for making my MA journey in PNU bearable and rewarding. Kudos to more international and national paper presentations together! I did not think MA would be this fun with you!

To **Department of Education – Tabaco City Division**, thank you for allowing me to conduct my study in your division. My earnest appreciation to the participating school and teachers for making this study possible.

To **Lakas Angkan Ministry Family**, thank you for the continuous prayers and spiritual guidance. Truly, this is God's will.

To my family, **Papa Henry**, **Mama Elma**, **Ate Michelle**, **Kuya Chan**, **Olan**, **Ehla**, **Mamatoy** and **Papatoy**, thank you for the love and support. You have been my strength ever since. To **Benyl John A. Arevalo**, thank you for the inspiration and understanding. *Para po ini saindo.*

To the Name of the Lord Jesus Christ be all the glory, honor, and praises!

Dios mabalos!

Table of Contents

List of Tables

List of Figures

List of Appendices

ABSTRACT

Name:	**Judy Vargas Bongala**
Title:	**CURRICULUM CONTINUITY AND PROGRESSION IN TEACHING JUNIOR HIGH SCHOOL MATHEMATICS**
Key Concepts:	**Continuity, Progression, Mathematics, Curriculum, Junior High School, Spiral Curriculum**
Degree:	**Master of Arts in Mathematics Education with specialization in Secondary School Teaching**
Adviser:	**Rosie L. Conde, Ph.D.**

This study sought to explore how mathematics teachers made use of the learners' previous knowledge to facilitate the current learning through the lens of Bruner's key principles of spiral curriculum to attain curriculum continuity and progression. Curriculum continuity is characterized by Bruner's principles, namely (i) revisiting of topics throughout the school career and (ii) building upon previously learned knowledge relating to the new knowledge, while curriculum progression is (iii) moving from simple to complex task. This was explored by identifying teachers' understanding and view of continuity and spiral progression in mathematics, how teachers designed lessons, implemented, and assessed student learning. Based on the result, inputs to curricular design were generated.

Following the qualitative case study design, the study involved ten (10) Junior High School Mathematics teachers in a public secondary school in the province of Albay, from whom different data were elicited through individual interviews, class observations,

collection of artifacts, and focus group discussion. Validated interview guides were used for the unstructured interview and focus group discussion. The data were transcribed and analyzed into themes using thematic analysis verified by NVivo 12 Pro, a qualitative data analysis software. Data from the different sources were triangulated to increase the validity of the themes.

Results showed that teachers describe continuity as the presence of common skills, topics, or competencies from one grade level to another, and as the utilization of previous concepts for succeeding lessons. Further, to them progression in the curriculum is the arrangement of topics and competencies with increasing difficulty. They describe teaching in spiral progression approach as giving "a little of everything" to students. The participants have the following views on the continuity and progression of the mathematics curriculum: discontinuity of instruction and student' learning, slow progression in learning, poor mastery of mathematics content, conflict between quantity and quality of competencies, and contrasting impact and effect to different types of learners.

Results also revealed that the participants have difficulty meeting the demands and standards in implementing the spiral progression in teaching mathematics. Specifically, Bruner's 2nd and 3rd key principles such as knowledge build-up from students' prior knowledge and moving from simple to complex task were challenging for teachers to implement due to students' prior knowledge, type of student, congested curriculum, and geographical disadvantage causing class suspensions and unfinished curriculum at the end of school year. These factors were perceived by the teachers to have learning implications to students' learning such as discontinuity and slow learning progression in mathematics

against the expected standards, which are characteristics of a Broken Spiral. Inputs to curricular design based on teachers' perceptions and practices include decongestion of curriculum, emphasis on the horizontal articulation of mathematics content, strengthening of continuity to achieve progression, and revisiting spiral progression approach in mathematics vis-à-vis teaching and learning outcomes. Recommendations for future studies are discussed in this paper.

Chapter 1

THE PROBLEM AND LITERATURE REVIEW

1.1 Background of the Study

Among the Southeast Asian regions, the Philippines fall short on the duration of primary to university level which was seen as one of the reasons why many Filipino learners failed to master the competencies and gain lifelong learning skills (Seameo Innotech, 2012). The Department of Education in its effort to address this shortcoming embarked on a comprehensive educational reform in the basic education known as K to 12 Basic Education Program under the Enhanced Basic Education Act of 2011 (RA 10533) implemented in 2012. The K-12 spiral curriculum is characterized as seamless, decongested, relevant, responsive, enriched and learner-centered (Seameo Innotech, 2012) using Bruner’s spiral progression approach.

Jerome Bruner’s spiral curriculum approach has three key principles: (a) revisiting topics throughout the school career, (b) building upon previously learned knowledge relating to the new knowledge, and (c) moving from simple to complex task (Ulep, 2013). With these principles, the learners are provided with opportunity to get familiar on the basic subject contents in their early years while widening and deepening their understanding as they get promoted to higher levels. Hence, in the design of the spiral curriculum using the spiral progression approach, curriculum designers have to create units of work that are starting off where the previous unit ended and increasing in complexity (Drew, 2020).

In Mathematics, spiral progression is used to ensure mastery of knowledge and skills after each level (RA 10533, Sec. 10). The learners are exposed to different mathematics contents such as patterns and algebra, geometry, and statistics and probability across grade levels. As their grade level progresses, the competencies from each content are becoming more complex. That is, competencies are vertically progressing while horizontally integrating the different contents or areas of mathematics. Therefore, what students have learned in the past must be continued with progression.

However, according to research findings of the University of Melbourne as presented by Corpuz (2012), there were glitches in Math in terms of continuity and progression of the skills. This is supported by growing studies in the country where results revealed unnecessary repetition of topics, limited progress with the new skills, underdeveloped pre-requisites needed for more complex task, and poor linking of the learned topics (Acharya, 2017; Gamoran, 2001; Resurreccion & Adanza, 2015). Supposed to be, the benefit of a continuous and progressive curriculum is felt more conclusively in the later years (Coelho& Moles, 2016). Ideally, students in Grade 10 must exhibit mastery of the skills and content since the full cycle of junior high school (JHS) mathematics has been completed. Unfortunately, there is less empirical evidence to support the claim in the country's current education setting. Review of students' mathematics performance from secondary schools in the Philippines reveals that students have difficulty in attaining mastery of contents and skills against the expected performance standards. These non-progressive performances of students seem to be contrary to what the spiral progression projects. Public school teachers perceive that spiral progression is more disadvantageous than advantageous in teaching and learning (Resurreccion et al., 2015).

The continuity and progression of skills are tenets of spiral curriculum (Drew, 2020). In this study, through the key principles of spiral approach, curriculum continuity is characterized by the first two principles namely (a) revisiting of topics throughout the school career and (b) building upon previously learned knowledge relating to the new knowledge as supported by the study of Khataybeh et al, (2011). Meanwhile, progression is characterized by (c) moving from simple to complex task.

Teachers as curriculum implementers are expected to have full understanding of the significant changes and be equipped in order to become adaptive and effective in supporting the dynamic standards of educating students. Mathematics in its very nature requires mastery of basic skills. Amplified by the spiral and progressive approach, it is then a challenge to every mathematics teacher how they are going to provide opportunities for students to learn best by building on the things they know now and have known in the past. There is a dearth of study in the country describing how the continuity and progression of mathematics curriculum is being carried out in junior high school and even in different stages of schooling. With this, the researcher explored how mathematics teachers made use of the learner's previous knowledge to facilitate the current learning to attain continuity and progression in teaching JHS mathematics. This was done by determining teachers' understanding and view of continuity and spiral progression. How the lessons were designed, implemented, and assessed to ensure curriculum continuity and progression were also examined in terms of the principles of the spiral progression approach. This revisiting and updating of the curriculum from the grassroots' standpoint has generated inputs to curricular design for continuous and progressive teaching of JHS mathematics.

1.2 Literature Review

The education community has a long list of updating and informing through research studies in an effort to help address the existing teaching-learning dilemmas. In this literature review, four major topics were categorized: spiral curriculum and spiral progression approach; curriculum continuity; curriculum progression; and mathematics teaching in the K-12. Review of these studies underpins the need for curriculum continuity and progression in teaching mathematics in the K-12 curriculum.

Implementation of Spiral Curriculum in the Philippines

There are many educational design and strategies in educational programs such as linear programming, modular, pyramid core, subject network project-centered program, interrogation centered programming, and spiral (Incebacak et al., 2016). In the Philippines, the spiral curriculum is used as the educational design.

In spiral curriculum, the contents are organized in a manner that they are revisited across grade levels with increasing complexity. A wide number of topics are taught in the early grades and cycled all throughout the years (Orale & Uy, 2018). The students' knowledge 'spirals upward' as they master the initial topic and new knowledge is introduced enabling them to reinforce what is already learned (Hatuina, 2013). Also, it has been viewed to solve the decongestion of the topics for retention and mastery of competencies in contrast to the old curriculum. The K-12 curriculum in the Philippines through the spiral progression approach ensures smooth transition between grade levels (Seameo Innotech, 2012). It uses inquiry based, integrative and constructive approaches to develop the competencies. Many countries are also using this kind of curriculum design: Singapore, America, China, Japan and Taiwan, to name some.

Advocates of spiral progression approach claim the following benefits: (i) helps reinforce learning, (ii) allows logical progression of topics, (iii) encourages students to apply previous learning to new situations, and (iv) helps learners appreciate the connections of and among different content strands (Diwa, 2018). However, spiral curriculum is a complicated process to implement (Coelho & Moles, 2015); thus, teachers experience difficulties and problems in implementing the curriculum. Unfocused, extensive and challenging remain to be the biggest impediment of spiral curriculum (Orbe at al., 2018).

Studies on the implementation of spiral curriculum in the Philippines meet on a common standpoint: lack of teacher preparation. In a study conducted by Braza and Supapo (2014) in a rural school, teachers lack trainings and seminars about the K-12 mathematics curriculum and do not have clear standard operating procedures for its effective implementation. This directly affects the teachers to have weak teaching strategies. More so, they are having difficulty to teach the hard contents efficiently. Unavailability of instructional materials also hinders the teachers to teach effectively, prompted by the several inclusions of content areas in mathematics. These problems brought ripple effect on students' learning as teachers observed that students do not master the basic mathematical concepts and skills, show poor problem solving and critical thinking skills, and indifferent student behavior. Nonetheless, to overcome the shortcomings, teachers do their own research and look for available resources about the new mathematics curriculum and implementation suggestions. Sharing of learning modules and review lessons was exemplified. These, however, are the immediate solutions taken by the rural teachers and do not guarantee their lasting effect to solve the main problems. The same case is observed in science where teacher's content, pedagogy and assessment are problematic due to poor training and lack of necessary preparation in using the approach (Orbe et al., 2018). Situations like this negatively affect teachers' self-efficacy and competence. Inadequacy in the academic and practical training of teachers has been a perennial problem and implementing a new policy is foreseen as a failure unless seriously taken action (Sergio, 2012).

Teachers must have expertise on the content areas in the mathematics curriculum: Numbers and Number Sense, Geometry, Patterns and Algebra, Measurement, and Statistics and Probability (Seameo Innotech, 2012). Teachers' content knowledge on the different areas will make it easier for them to interconnect one field to another and consider the focus for the year and the future levels. However, out-of-field teaching is prevalent in K-12 (Orale & Uy, 2018). There are math teachers who are non-math majors. They are requested to teach the subject because of the lack of available mathematics teacher despite hundreds of applicants unable to get teaching items. Teachers rely heavily on available textbooks and materials to understand and connect the topics within the same level and their previous level. Some teachers buy books or attend graduate schooling using their own pockets. Despite their efforts, they feel that they are not enough.

When implemented as intended, the spiral curriculum and spiral progression approach is effective for all learners including those struggling students (Bell et al., 2007) but the expected benefit could never be attained in the current promotion and retention practices of the teachers in the country (Oral et al., 2018).

Continuity of the Curriculum

The term continuity is described similarly by Bennetts (2002), Nicolescu and Petrescu (2014), and Owen and Ryan (2001) as the cyclical repetition of 'significant' features or characteristics of the subject on a regular basis across it in the teaching and learning design. In geography, for example in South Africa, one of the significant features is the use of certain resources. The use of the resources such as maps, basic tools in geography and Geographical Information System (GIS) are run through each of the 10 years of General Education Training (Owen & Ryan, 2001). Steed and Sudworth (1985) associate continuity on building what has gone before. In a profound context by Curriculum and Standards (2004), curriculum continuity is knowing the topics that have been covered by the students, knowing the competencies and understanding what have been mastered, and knowing how the previous lessons in the subject were taught. In terms of learning experiences, Braud et al. (2005) refer continuity as the ways in which the school or teacher plans and facilitates students' experiences to provide sufficient challenge and progress in a recognizable curricular landscape.

Based on the definitions and description of several studies on continuity, it can be noted that the concept can be attributed to the first two principles of the spiral curriculum, namely on (a) revisiting topics and (b) new knowledge being developed in each revisit has a relationship with previously learned knowledge. Revisiting the topic as indication of continuity is supported by ideas of Bennetts, Nicolescu, Petrescu, Owen and Ryan. As significant features are repeated the contents are automatically revisited; while the Curriculum Standard, Steed and Sudworth's idea of continuity is the same as the second principle of the spiral approach which is utilizing past knowledge in the formation of new knowledge. Continuity as a feature of spiral curriculum in terms of the two specific principles is supported in the study of curriculum planning in English (Khataybeh & Ateeg, 2011).

Beets and Le Grange (2005) studied the continuity and progression in Geography at South Africa between General Education and Training (basic education) and Further Education and Training (tertiary). They presented the evidences of continuity in Geography in terms of content, learning activities, common assumptions about the nature of the subject, geographical skills, and use of certain resources. For content, the concepts of people, place, resources and environment run through each of the 10 years in their basic education and the same concepts are integrated in tertiary level. Geography is taught using the same types of learning activity such as field work, integration of ICT, and collaborative learning. Interrelationships among people, resources, environment, and critical analysis of issues from local to global scale are common in the whole system of schooling in Geography. Maps like topographical and orthophoto maps are constantly used. However, the content selection falls on the teacher and more likely from the textbooks. Although the standards were set to ensure uniformity and continuity in the education system in South Africa, teachers' individual interpretation and curriculum development initiatives may affect the quality of the Geography teaching, learning and assessment. The progression in geographical education is expected to extend the content, increase complexity, introduce geographical studies from local to global, and increase opportunities to study social, economic, political and environmental issues. Despite the existence of reference for progression in the content section of Geography, there are other areas where progression is not addressed. The study of Beets and Le Grange (2005) pointed out that the curriculum documents, although carefully planned and sound, have little substance to support teachers. The teachers need practical guidance in translating assessment standards to classroom activities, to organise teaching and learning, and to plot the students' evidence of achievement on the continuum of progression.

Pinilla (2007) took the teaching of fraction and rational number as an example of discontinuity. In his analysis of mathematical education issues regarding fraction, he argues that pupil will not understand and learn the concept of fraction by giving only its definition. According to Pinilla, there are at least twelve different interpretations of the fraction applicable at a primary level. However, in the national mathematics curriculum in UK, some interpretations of the fraction are not recalled and even though mentioned, they were not related with the notion of the fraction as introduced in the primary level. In the primary level, the teacher puts less emphasis that the fraction does not belong to the whole numbers category. This important characteristic of fraction is seldom recalled in the primary level. Thus, the students will consider fraction more as whole number used in counting of individual units as a means of division and partitioning schemes as splitting, folding or halving. This further branches out to problems in teaching and learning rational numbers. The study recommends conducting constructive debates on mathematics curriculum on how it will ensure a stable and coherent frame leading to the acquisition of expected competencies and linking them to other parts of mathematics therefore attaining interdisciplinary and transdiciplinary ways of teaching and learning.

The Education Department of Hong Kong conducted a longitudinal study on the continuity of curriculum and teaching practices between the junior and secondary levels from 1990 to 1992. The study on the curriculum was carried out through paper analysis of the curriculum prepared by the Curriculum Development Council. This was recommended by the Education Department of Hong Kong to be used in schools to analyze the objectives, design and content of the junior and senior secondary curricula. The study on teachers' practices was completed by means of students' achievement in the Hong Kong Attainment Tests in Chinese, English and Mathematics together with interviews to students and classroom observations. Results showed that there is coherence of curriculum in the selected subjects from junior to senior secondary levels. However, students indicated that there was not proper guidance from teachers and actually had drops in the pupils' learning attitude and learning environment in the class. They had challenges in the new and diversified senior secondary curriculum, particularly in English.

On pupils' perceptions and teachers' awareness of continuity in mathematics instruction, Chauraya (2008) found out that students experience challenges when transferring from one school or class to another. According to him, the adverse effect on students' transfer can be minimized if the transition is perceived as a continuous process by the learner and the continuity in instruction helps the learner perceive the curriculum as a continuously cumulative and progressive experience. His study was completed in six urban schools in Zimbabwe through questionnaires and interviews. The key aspects that were examined were the content linkages and teachers' pedagogical continuity. Results showed that students perceived continuity in the mathematics content but showed opposite result on how they perceive continuity of their teachers' instructional practices. Despite this, students continue to perceive mathematics positively. In the same study, it was revealed that there were little efforts done by the heads and teachers to ensure curriculum continuity in mathematics instruction but showed appreciation of the need for it.

There is a dearth of study in the country describing how the continuity and progression of mathematics curriculum is being carried out in junior high school and even in different stages of schooling. Foreign studies, on the other hand, draw much more attention to cross-institutional transfer than to within-school transition experiences.

Curriculum Continuity in Spiral Progression Approach. In a study of Coelho and Moles (2015), students perceive that they are having the opportunity to revisit knowledge which is beneficial to understanding. They think that they have gone beyond memorizing to understanding and felt their long-term memory improved as well as their confidence. However, there were some frustrations brought by the spiral curriculum. Their main problem with it is the lack of information on exactly what knowledge is desired for each grade. They are confused with how much depth of knowledge is required. There is a conflict between being overwhelmed with learning everything at the first exposure of the topic and being irritated with too much repeated topics at successive loops. According to them, some topics are not spiralled and were just revisited each year with the same depth.

In the implementation of the mathematics curriculum in the Philippines, there is less evidence that students find connections on the learned lessons across their grade levels in junior high school; and although the concepts and skills are expected to become more challenging, students have difficulty adapting to the complexities. This is reflected in the math proficiency in Algebra of the pioneer batch of K-12 revealing that their level is only at Approaching Proficiency. The data showed that the students did not gain mastery in any of the topics taught to them across levels. To note, one third of the students are at the beginning level in algebraic expressions even when the concepts and skills in the spiral topic like exponents and polynomials were taught primarily in Grade 7 and were revisited in Grades 8 and 9 (Dimaculangan, 2016). The same result from another study conducted in 2015 where the overall mathematics achievement of grade 8 students in the three content areas namely Patterns and Algebra, Geometry and Statistics and Probability is at Beginning level (Capate & Lapinid, 2015). Clearly, students' learning are disjointed and discontinued. Their foundation in learning progression is weak. One of the factors that makes mathematics difficult for students is their inability to link the new and previously learned mathematical concepts, to which the teachers play a very important role of guiding the learners form related mathematical structure (Acharya, 2017). In other subject like science, secondary school science teachers view that the spiral curriculum does not avoid disjunction between stages of schooling. More so, science teachers find it difficult to sequence necessary pre-skills that the students first have to acquire before introducing difficult skills (Resurreccion & Adanza, 2015). The same sentiment is expressed by the elementary mathematics teachers in France. Having more than 10 years of teaching experience, they expressed that they are faced with many problems when trying to teach students using the spiral approach (Incebacak et al., 2016). Teachers view that the spiral approach is structured constantly to transfer information and does not give the students the opportunity to review. Moreover, it does not let the teacher's bridge connections between the subjects because of their worries of keeping up the curriculum. The teachers believed that establishing connections among teaching methods and subjects will enable students to obtain permanent information.

Teachers' autonomy and approaches are some of the factors that hinder curriculum continuity (Benyon, 2007). The non-coherent and non-consistent programs of work make an attack on discontinuity. This holds true to the abovementioned case of the grade 8 students. It was found out that in that certain grade level there are non-alignment and significant inconsistencies among the K to 12 Mathematics Competencies provided by DepEd to the stated instructional objectives of the teachers in their instructional plan and to the constructed assessment tool. Although the developed plans, frameworks and curricular guides detail how various programs should be implemented, the level of actual adherence to these plans varies greatly (Durlak & Wells, 1997).

Results and recommendations from these curriculum studies are in unison that improvement in curriculum continuity must be effected through better practice and liaisons. Cross-phase liaisons are deemed desirable to improve continuity and progression in the curriculum (Chapman, 2002). The feeder schools and secondary schools must communicate to inform the learning environment of the primary and secondary classroom, and the ways in which the subject is delivered. Exchange of pupils' records and tasks or records of what the feeder or primary school has covered is also recommended. Teacher exchange or teacher visit is also encouraged. This may include viewing of previous works in the subject that will provide background knowledge of the work undertaken and the competencies attained. Linking or bridging projects supports curriculum continuity (Galton et al., 2003). In this project, students were given set of materials in their last few weeks in primary school, to be continued after they have transferred to secondary school. This is found out to have increasing support continuity of pedagogy and curriculum as both primary and secondary teachers jointly plan for the materials. Similarly, summer school could provide a smoother transition from one stage to another.

Curriculum Progression

Progression focuses on how learning advances (Bennetts, 2002). The lessons are taught in increasing breadth to extend students' knowledge and increasing depth to cope with complex and more advance concepts. In particular, it facilitates advances in learning and gradual gains of knowledge by structuring of content and sequencing of learning activities appropriate for the students. It can be noted that the concept of progression is one of the principles of spiral curriculum: the complexity of the topic increases with each revisit.

In sequencing the contents, easier topics are introduced in the early stage of schooling and ideas are built from there, moving to harder concepts. Sequencing of topics is crucial because it provides linkages of lessons previously covered as the students spiral upward in their course of learning (Dowding, 1993). However, students learn at their own phase (Cabansag, 2014). There are fast learners as well as late bloomers. In a progressive manner, unable to master the basic skills or competencies most likely will affect students' succeeding performance negatively. One way to help students cope this is to give more drills and stay longer on the topic to ensure mastery. This is not a good idea for spiral curriculum as it will affect the time allotted for the next.

In United States, regression instead of progression in the spiral approach was proven as early as 2000 (US Department of Education 2001). Students who perform poorly in US mathematics are subject to special type of spiral curriculum termed as circular curriculum because the topics are repeated over and over again until students stop learning Math (Gamoran, 2001).

In the Philippines, problems in progression have been evident. In the study of Orale and Uy (2018), out of 66 students in the 10th grade who were about to move to grade 11 subjected to mathematics aptitude test, seventy-one percent (71%) are still beginners of Grade 10 mathematics; and when assessed using the test items from Grade 7 to Grade 8, the level of proficiency was still the same. The result revealed that even in their previous years, the students have not attained mastery. The result implies that the teacher seems to advance the students to the next more complex subject matter without the required mastery Moreover, the next teacher is clueless as to where the student learning had stopped from the previous year, making the spiral progression approach not working. What is being developed is a broken spiral where the students were unable to develop proficiency before proceeding to the next. The mass promotion recommended by the Department of Education is the main reason for the unsuccessful spiral curriculum (Orale & Uy, 2018). The danger lies when students are promoted without learning. Although there is no written policy about the mass promotion, there are pending bills that are misinterpreted such as the no Filipino Child Left

Behind Act of 2010 and the Philippine Education for All 2015. According to the teachers in the interview conducted by Orale and Uy (2018), their principal would not allow them to retain or drop students since one of the performance indicators of the school and the principal is based on the number of promotion or graduation rate (Read, 2017). Lower retention rate means better performance. Teachers are also the one to be blamed on the students' absences and required to conduct remedial classes without remuneration. Thus, instead of conducting remedial classes, teachers would promote students to the next level, and their principal would be happier. Because of this practice, teachers in the next level most likely will not deliver the intended curriculum for that level; instead, they will teach the lessons and leave the learners to cope with them. This jeopardizes the spiral progression. On the other hand, strictly following the intended curriculum knowing that the students have not mastered the basic competencies will lead to superficial learning.

In terms of the level of activities, it is of much importance that students have prior knowledge. Capangpangan (2015) stressed that it is very much dragging to reintroduce the past lesson for the present lesson be achieved. The class becomes a review center, reviewing the previous discussions with no progression at all. Aside from the students' knowledge, attack on spiral progression is brought also by the lack of laboratory and instructional materials. Spiral progression of content is not followed because there are some activities that are not possible to perform caused by the insufficiency of laboratory materials, modules and books.

In another subject like Chemistry, science teachers revealed their disappointment in instruction using the spiral progression K-12 framework. Teachers reported how the curriculum is not spiral, despite the documents saying it is. The main problem viewed by the science teachers is the sequence of the lessons. According to them, the lessons in the previous grade level do not serve as prerequisite for the succeeding lessons. To bridge the gap, they have to teach first the prerequisites. Because of this, the allotted time per content standard becomes limited and problematic. More so, changing of the subject area quarterly has resulted to lack of depth, lack of concentration, and a very minimal focus on each subject areas contrary to what the spiral progression has been claiming to address. Curriculum developers must ensure that the previous topics can be linked easily to the current topics. The spiral approach challenges teachers' instruction and competence. However, there are teachers who lack adequate training and necessary preparation in using the approach; hence, least possible learning may exist within students (Orbe et al., 2018).

The Mathematics Framework for Philippine Basic Education promotes a progressive nature of concepts. Following the spiral approach, the scope and sequence of the content are developed such that the competencies and skills are revisited at each grade level with increasing depth. To guide the teachers in instruction, the Department of Education developed curriculum guide in Mathematics specifying the content standards, performance standards, and learning competencies expected at specific grade level. Also, The Philippine Council of Mathematics Teacher Education (MATHTED) and Science Education Institute of DOST (SEI-DOST) developed the Framework for Philippine Mathematics Teacher Education which states the principles that must guide every mathematics teacher in pursuit of good quality education and the vision of a fully competent teacher such as possessing mathematical content and pedagogical knowledge. Along with this, the same departments produced the Mathematics Framework for Philippine Basic Education. This highlights the goals of mathematics education in the Philippines and examples of cognitive demands and assessment targets for grade levels arranged in increasing breadth and depth.

Relationship between Continuity and Progression. Explaining the relationship or connection between the mathematics concepts from different levels of metal ability is a must for mathematics teachers. However, to do so, Attard (2010) argued that it is absolutely necessary for the mathematics teacher to get familiar with the content at least for the adjacent years.

In the short exposition of a complete analysis of Nicolescu and Petrescu in Rome (2014) on the continuity of Mathematics curriculum between primary and secondary school, it shows that secondary students experience very less and inconsistent academic progress in mathematics as a result of the teaching and learning design. This is so because connecting the previous knowledge to the on-going classroom experience is not part of their learning strategies in mathematics.

To put together the relationship between continuity and progression, Butt (2002) points out that in order to have a solid foundation of continuity, it should ensure that learner's prior learning is built and connected upon the next course of study. Without progression, students may merely continue to repeat the same content in different grades or just master the same concept from different learning approaches; hence, advances in learning are compromised. With this, fast-paced learners will feel bored and might disengage in learning while slow-paced learners will be deprived of the need to challenge their potential. For progression to be achieved there had to be continuity (Chapman, 2002) "...sharp discontinuities can impede progression in learning. Such discontinuities are most likely to occur when pupils move from one teacher to another and from one school to another" (as cited in Chapman, 2002).

Wood and Bennett (2001) has seen close link between continuity and progression in learning in ways such as: smooth, continuous process; ensuring the next stage is appropriate to the child's present needs and learning styles; visiting and re-visiting topics; helping the children's progression; ensuring consistency within a whole-school approach; planning continuity in specific activities; and liaising with previous setting.

Curriculum developers consider the presence of continuity and progression in designing curricula as essential tenets of the school curriculum (Braund & Driver, 2007) and key to effective teaching and learning (Nicolescu & Petrescu, 2014; Benyon, 2007; Beets & Le Grange, 2005).

Mathematics Curriculum in the Philippines

Before the introduction of the K-12 curriculum, the curriculum followed a disciplinal approach where the content was divided into distinct and separate subjects or disciplines, such as English, science, mathematics, and social studies. The areas in the subject (i.e. in math: algebra, geometry, trigonometry, statistics, calculus) were categorized hierarchically and the level corresponded to students' grade level. The contents in a subject were taught in a school year by one teacher. This allowed for minimal repetition of concepts and made it easy for teachers to monitor students' progress with regard the attainment of the learning competencies. In the new curriculum with the new approach, the areas in a subject are taught in all year levels such that the level of complexity in the content varies. Students are engaged into the different areas in the subject but the content level is ensured to be appropriate for the grade level and age.

In Mathematics, the areas included in the curriculum are Numbers and Number Sense, Measurement, Geometry, Patterns and Algebra, and Statistics and Probability (Seameo Innotech, 2012). These subject areas are taught across grade levels. The content in each area are ‘chunked’ and grouped according to levels of complexity. The basic competencies among the four areas in Mathematics are taught in Grade 7, while the most complex competencies are in Grade 10. This setting requires the teacher to be multifaceted in terms of curricular content in mathematics. This also posed challenge in ensuring the sequence, connection, and progression of the learning competencies. Likewise, the teacher must avoid repetition of unnecessary concepts for this will risk the attainment of expected learning outcome specified for the grade level.

The country puts its great hope in the spiral curriculum as the most comprehensive educational reform ever done in the country. However, according to the research findings of the University of Melbourne as presented by Corpuz (2012), there were glitches in Math in terms of continuity and progression of the skills. These are only few of the findings: Algebra is taught in grade 7 but ignored in grade 9; materials in statistics are not well-sequenced and the subject is discontinuous; and there is a gap between grade 7 and grade 8 Geometry. Non-mastery of subject contents were reported. To note, students who are about to move to Grade 11 are still at the Beginners Level of Grade 10 mathematics (Orale & Uy, 2018); while in another study. The level is at Approaching Proficiency of the Grade 10 standards (Dimaculangan, 2016). In other studies, the mathematics achievement of students in grade 8 is only at Beginning Level (Orale & Uy, 2018; Capate & Lapinid, 2015).

1.3 Theoretical and Conceptual Framework

While the spiral curriculum prompts students to be involved actively in the learning process, there is still a need to look deeper into how teachers provide an engaging environment to facilitate learning. This study focuses on how teachers make use of students' previous knowledge to facilitate students' learning.

This study is anchored on Jerome Bruner's Spiral Curriculum Model (1960) and relevant theories. Bruner has enormous contribution to understand the education process and his particular interest is the cognitive development of children and the appropriate forms of learning experiences that must be given to students (GTCE, 2006). On his perspective, the goal of education must be towards intellectual development.

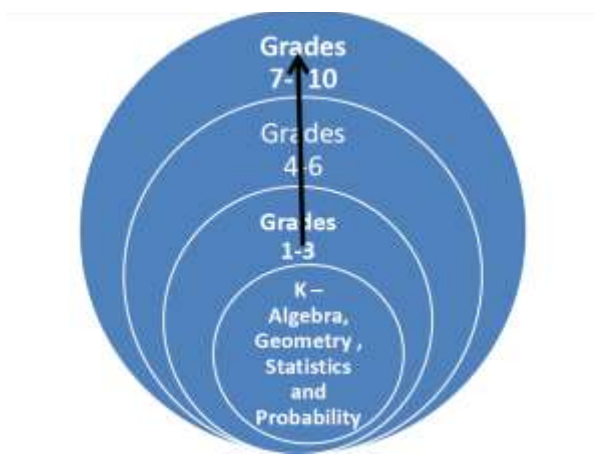
Prior to his proposal of the spiral progression theory, Bruner hypothesized three modes of cognitive representation or stages of human cognition: enactive, iconic, and symbolic. The modes of representation are the ways in which the information is stored and encoded in memory. In enactive stage, students need active manipulation of objects to develop understanding, which is exposing students to tangible materials. Students under iconic stage are now capable of visualizing information and no longer need to manipulate them directly. In the symbolic stage, which is the aim of human cognition, students are able to represent the world using abstract ideas. They are able to judge, evaluate and think critically. To effectively connect ideas and generate their own understanding, students must go through all the stages in such order. Here, teachers' guidance must be present as students undergo the processes via "scaffolding" p facilitate students' learning known as Vygotsky's Zone of Proximal Development. Facilitating the learning does not mean fact feeding, rather, assisting students to have better comprehension and gain "new truths".

Bruner's three stages of human cognition merged with Vygosky's zone of proximal development is what he terms Spiral Curriculum (Clabaugh, 2010). In his books "The Process of Education" (1960) and "The Culture of Education" (1996), he argued that learning can start from intuition going to formal and abstract ways. Bruner describes spiral curriculum as a process of building knowledge based on previously learned information in a spiralling fashion, enabling the learners to connect prior schematic concepts (Clabaugh, 2010). He hypothesized that even the most complex material can be understood by very young child if properly structured and presented (EPI, 2012). When the model is translated into a course of study, the same topics are designed throughout the school career with increasing complexity and reinforcing. Hence, early teaching of any subject must be on grasping of basic ideas; have them revisited, and then building upon them until the students understand them fully. Bruner's theory of discovery learning was also one of the bases of spiral curriculum, that students learn best by building on the things they know now and have known in the past (Bruner, 1960).

In this view, the role of a teacher, according to Bruner, should not be on the transfer of information by rote learning, but instead to facilitate the learning process. A teacher is expected to design lessons that help students discover the relationship between bits of information which is the primary goal of establishing continuity and progression in the curriculum. To do this, a teacher must give students the information they need, but without organizing for them. Students must be the one to discover the organization of ideas on their own with the help of the teacher. Teachers as coaches or facilitators must be equipped and trained properly. Its success relies on the teachers' knowledge about the curriculum, their teaching strategies and mastery of the subject (Duze, 2012). Students will experience difficulty in adapting to the spiral approach if teachers plan to teach using only the teachers' level of understanding (Resurreccion et al., 2015). Adequate professional seminars and trainings will help teachers better understand the spiral curriculum since better understanding is most likely to lead to better practice.

Figure 1

Spiral Curriculum Model in K-12 Math

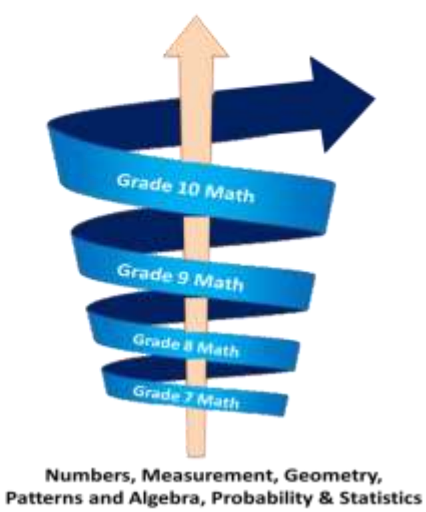


Note: Adapted from "The Spiral Progression Approach in the K to 12 Curriculum" by Corpuz (2012).

Corpuz (2012) illustrates in Figure 1 the spiral curriculum in K-12 Math where the different mathematics areas or contents are present across the basic education grade levels. The increasing loop represents the widening of scope and the increasing complexity of the topics. For this study, only the JHS curriculum was captured; hence, a modified version of Corpuz' spiral mathematics is used as shown in Figure 2. The continuous spiralling represents continuum of competencies. Aside from this, the five content areas in math grow in progression: increasing depth and breadth, as it is being revisited in each grade as represented by the arrow upward. Depth refers to the extent to which specific topics are amplified, focused, and explored; while the breadth refers to the span or scope of knowledge (SUNY Empire State College, 2020).

Figure 2

Mathematics Curriculum using Spiral Progression Approach in JHS



The Spiral progression approach has three key principles namely: (a) revisiting topics throughout the school career, (b) building upon previously learned knowledge relating to the new knowledge, and (c) moving from simple to complex task (Ulep, 2013; Drew, 2020). Presence of these three principles in teaching has inherent effect to curriculum continuity and progression.

Revisiting Topics

Bruner suggests that the curriculum should revisit the fundamental ideas repeatedly. Revisiting is not intended for mere repetition only; rather, the continuous exposure of the topics is a means of reviewing what students' have previously learned which has something to do with the new lesson. A lesson must be designed in a way that allows revisiting of pre-requisites. It is important that teachers have a clear picture in their minds of the knowledge requirements of different tasks and assess both the amount and nature of students' prior knowledge.

Relationship between New and Previous Knowledge

Students learn better when they can connect what they already know to what they are learning. However, connecting lessons do not come easily for students. With this, teachers should not assume that students will draw on relevant prior knowledge at an instant; instead, they should deliberately activate students' prior knowledge to help them create links to new knowledge (Ambrose, et. al 2010).

Bruner argued that for effective "transfer" to happen, a greater emphasis must be drawn to finding connections among different experiences in learning rather than focusing on mastery of facts. To achieve this, teachers must provide guidance to students as they learn through enquiry. Thus, it is important that teachers know what prior knowledge students have and utilize them in the formation of new knowledge. However, students' prior knowledge can either help or hinder their learning. According to Ambrose et al (2010), when learning new material, students may draw on knowledge that is inappropriate for the context of the new lesson. This may distort the interpretation of the new material and impede new learning. Hence, teachers must guide students where their prior knowledge is and is not applicable by: (a) clearly explaining the conditions and context of applicability, (b) teaching abstract principles but providing also multiple examples and contexts, (c) pointing out differences and similarities, and (d) deliberately activating relevant prior knowledge to strengthen appropriate associations.

Exposing students to accurate information and valid evidence that contradicts with their flawed beliefs can correct the misconceptions. However, a single refutation is unlikely to be enough; thus, teachers must guide their students continually as they undergo series of refinement and conceptual change until they have deeply understood the concepts.

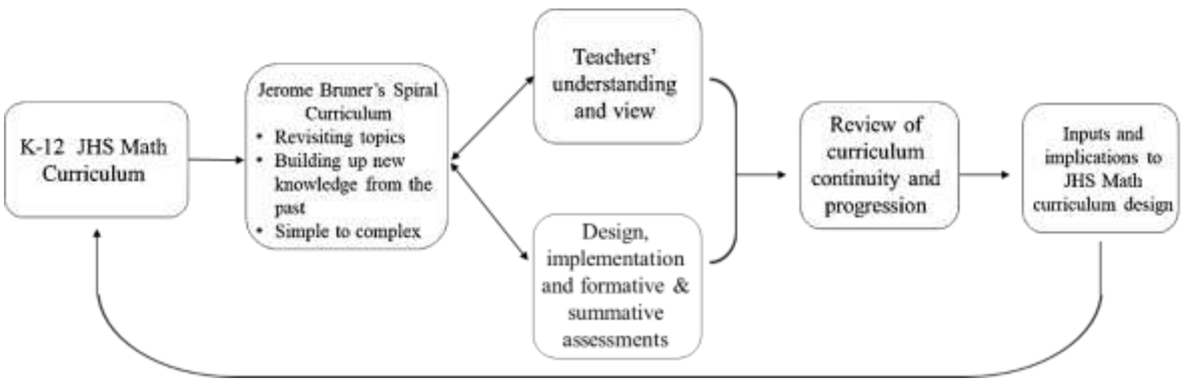
Increasing Complexity of the Topic

Increasing complexity means there is a successive level of difficulty when topics are visited. It is characterized by new objectives and fresh learning opportunities towards the final overall objectives (Harden & Stamper, 1999). Also, in order to have increasing complexity, every topic revisited must have more advanced applications than the previously covered area. The skill must be at a deeper level and more complex (Drew, 2020). Strong basic foundation allows the students to easily move to complex tasks and spiral higher.

The theories and concepts discussed posit the variables that are central in this study. As such, the given hypothesis and concepts served as the basis for the conceptual paradigm in Figure 3.

Figure 3

Conceptual Framework



The conceptual paradigm shows a visual process for exploring how teachers make use of students' previous knowledge to facilitate the current learning following Jerome Bruner's concept of spiral curriculum.

The first component of the model consists of the K-12 JHS Math Curriculum as reflected in the K to 12 Mathematics Curriculum Guide (2016). The second component shows Jerome Bruner's three key features spiral curriculum namely: (i) revisiting topic, (ii) building upon knowledge based on the previously learned lesson, and (iii) complexity of topics in each revisit, which are qualifying variables to determine the continuity and progression in teaching Math.

K-12 teachers are expected to adapt Bruner's idea of spiral curriculum. With this, the three key features were examined based from the teachers understanding and view. This becomes the third component. Their perspective of the spiral curriculum and the importance of curriculum continuity and progression in essence plays significant role in the planning and implementation of curriculum. Clear understanding of curriculum is an important factor in the success of the curriculum implementation (Chaudhary, 2015; Darsih 2017). Their knowledge influences the way they teach, assess their students and conduct the teaching-learning process (Darsih, 2017). Thus, it is necessary to complement the fourth component which is on examining how teachers design, implementation and assessment students' learning in accordance with Bruner's principles.

As the study go about the teachers' perception and practices, it has provided evidences and critical reflection on the continuity and progression of teaching spiral math. Examining evidenced-based means to optimize learning outcomes is a way of curriculum review (University of Calgary, 2015).

Lastly, the sixth component is towards generating inputs and implications to curriculum design focusing on the improvement of curriculum continuity and progression in teaching JHS mathematics. The foremost problems of curriculum design are the determination of scope of learning, establishing the continuity of learning and proper sequence of content, and unifying ideas from diverse areas (Taba, 1962).

Overall, the framework presupposed that teachers who have better understanding and view of continuity and spiral progression are making use of students' previous knowledge to facilitate students' learning through the presence of the spiral curriculum features in the design, implementation and assessment of lesson.

1.4 Research Questions

The main objective of the study was to explore how mathematics teachers made use of the learner's previous knowledge to facilitate the current learning to attain continuity and progression in teaching junior high school. Specifically, the study aims to answer the following questions:

1. What are the teachers' understanding and view of continuity and spiral progression?
2. How do teachers design the lesson, implement the lesson, and assess students' learning in terms of the following:
    i. revisiting topics
    ii. building upon previously learned knowledge relating to the new knowledge
    iii. moving from simple to complex task
3. What inputs to curriculum design can be suggested based on the results of the study?

1.5 Definition of Terms

The terms listed are defined conceptually and operationally as used in the study.

Assessment. This term conceptually refers to methods or tools used to measure, evaluate and document the academic readiness, learning progress, skills acquired or educational needs of students. The same definition is used in this study but focuses on classroom formative assessment.

Building Upon Previously Learned Knowledge. Conceptually defined by Ambrose, et. al (2010) as activating students' prior knowledge to help them create links to new knowledge. The same definition is used in this study.

Curriculum. It is the total structure of ideas and activities towards achieving the learning goal including objectives and outcomes (Matingwina, 2016).

Curriculum Design. It is defined conceptually and operationally as a process of selecting, organizing, executing, and evaluating learning experiences based on the needs, abilities and interests of the learners (Matingwina, 2016).

Continuity. It is defined conceptually and operationally as the cyclical repetition of significant features or characteristics of the subject on a regular basis (Bennetts, 2002; Nicolescu & Petrescu, 2014; Owen & Ryan, 2001). It also refers to the ways in which the school or teacher plans and facilitates students' experiences to provide sufficient challenge and progress in a recognizable curricular landscape (Braund & Driver, 2005). Continuity is represented by the two features of the spiral curriculum: (i) revisiting of topics and (ii) building upon previously learned knowledge relating to the new knowledge.

Implementation. It is defined generally as a set of planned and intentional activities designed to integrate evidence-based practices into real-world settings (Mitchell, 2011). Implementation is defined operationally as the process of putting a plan or idea into action.

Movement form Simple to Complex Tasks. There is a successive level of difficulty when topics are visited (Harden & Stamper, (1999). Operationally, it is the increasing level of complexity.

Progression. It is defined conceptually as the advancement of learning in terms of breadth and conceptual complexity (Adey, 2006). Operationally, it refers to the increase in the complexity of the topic and task with each revisit.

Revisiting Topics. This is conceptually and operationally defined as reviewing what students' have previously learned which has something to do with the new lesson.

Spiral Progression. This is defined conceptually and operationally as an approach to deliver the curriculum where the scope and sequence of the content are developed such that concepts and skills are revisited at each grade level with increasing depth (Ferido, 2013).

Chapter 2

METHODOLOGY

This chapter presents a description of the research design, research locale, sampling and target participants, proposed instruments, procedures for data gathering and analysis, and potential ethical issues.

2.1 Research Design

The curriculum and teachers are geared towards the shift to contemporary learning approaches. As such, there is a need to explore how teachers provide opportunities to students to learn best by building on the ideas they have. This study wanted to probe how teachers make use of students' previous knowledge to facilitate the formation of new knowledge. To best address this, the researcher conducted classroom observations, individual interviews, focus group discussions (FGD) and documentary analyses which are all forms of qualitative data gathering. Thus, this study employed a qualitative approach. A qualitative research involves exploring and understanding the meaning individuals or groups ascribe to a social and human problem or event (Creswell, 2014). Specifically, a qualitative case study design is a strategy of inquiry for intensive studies producing rich descriptions of a single phenomenon, event, organization, or program (Stake, 1995; Yin, 1994). Researchers for case study collect detailed information from variety of resources over a sustained period of time (Stake, 1995). Case study is the commonly used design to study curriculum continuity and progression (Samala, 2017; Coad & Jones, 1999; Chapman, 2002).

2.2 Research Locale

The study was conducted in one of the public secondary schools. The school is located in a 4th class city in the first district of Albay with agriculture and fishing as the main source of living.

The school has complete secondary education. The school has Special Program in Science, Technology and Engineering (STE) formerly Engineering and Science Education Program (ESEP). This is a science and mathematics oriented curriculum devised for high schools in the country which lay support to learners with interest and aptitude in Science as stipulated in DepEd Order No. 55 s. 2010. The JHS department of the school has 40 sections, with an average of 10 sections per grade level. Each grade level has 1 STE section. Approximately 10% of the JHS student population are in STE program. The remaining 90% are in non-STE program. There are ten Mathematics teachers, each handling 4 to 5 sections. The participating school was a feasible option as the research locale in this study since it offers JHS and implements the spiral curriculum.

2.3 Selection Criteria and Participants

Teachers play an integral part in the curriculum implementation process. They are not just mere curriculum implementers but are architects of change (Schleicher, 2011). Their experiences are valid evidences as basis to inform policies, curriculum development and/or reform. As part of the grassroots level, they are involved in re-framing, re-imaging and re-tooling of curricula (Pulido et al, 2013). In this study, the revisiting and updating of the curriculum from the grassroots' standpoint such as teachers have generated inputs to curricular design for continuous and progressive teaching in JHS mathematics. The participants' wholesome engagement in this study captured collective inputs and suggestions for a more relevant JHS mathematics curriculum.

Ten Junior High School math teachers in a public secondary school of year 2019-2020 served as the participants. Having a small number of math teachers in the site, the researcher considered all of them as participants to which they all agreed. Seven (7) are females while three (3) are males. Two of them handle Grade 7, three teaches in Grade 8, three as well in Grade 9, and the remaining two teachers in Grade 10. There was at least one representative teacher for each grade level. The study did not restrict on participants' number of years of teaching experience nor apply any limiting factors as long as they are teaching JHS Mathematics. Three (3) of them have a bachelors' degree in Mathematics education but with completed academic requirements in Administration and Supervision. Another 3 participants have aligned graduate studies in Mathematics Education, and the rest were bachelor's graduates in Mathematics education. Majority of the participants have been teaching mathematics for six or more years. The small sample allowed the researcher to focus more on the respondents and stay longer on the site essential for in depth study.

Table 1

Profile of the Participants

Characteristics		No. of Participants
Gender	Male	3
	Female	7

	Characteristics	No. of Participants
Grade Level Assigned	Grade 7	2
	Grade 8	3
	Grade 9	3
	Grade 10	2
Educational Attainment	MA Degree/CAR in Admin and Supervision	3
	MA Degree/CAR in MAEd Math	3
	With MA Units in MAEd Math	2
	Bachelor’s Degree	2
Bachelor’s Degree	As graduates of Education Math course	9
	Non-Education Math course	1
No. of Years of Teaching Experience (Teaching Math)	≤ 5	4
	$6 - 10$	2
	> 10	4

2.4 Instrument

Interview guides were used for the unstructured interview and focus group discussion (FGD). The guide questions seek to answer teachers’ understanding and view of continuity and spiral progression and how they design the lesson, implement the lesson, and assess students’ learning. A total of ten open-ended questions were prepared: three for unstructured interview and seven for the FGD. Three experts validated the questions using the Survey/Interview Validation Rubric for Expert Panel - VREP© by Marilyn K. Simon with ratings of 1=not acceptable; 2=below expectations; 3=meets expectations; and 4=exceeded expectations according to the criteria set in the VREP©. The researcher sought permission from the author and was allowed to use the validation instrument (see Appendix G, p. 105). The interview guides were rated as 3; thus, it was recommended for use with little modification suggested.

2. 5 Data Collection

An endorsement was sought from the school division followed by the approval of the school principal in coordination with the head of the mathematics department alongside the necessary consent and assent from the mathematics teachers. Data gathering was done on the first quarter of the school year 2019-2020 for a period of three months from the month of June to August 2019. Four data sources were involved: (1) individual interview, (2) class observation, (3) collection of artifacts (i.e. lesson plans), and (3) focus group discussion.

Individual Interview

The first data collection was through individual interviews. The participants were scheduled according to their availability. The interviews were conducted every other day and at most two teachers only were interviewed per scheduled date. Each interview took an average of 20 to 30 minutes and was conducted inside the school premise. The conversation was audio recorded and transcribed after the whole course of interview.

Class Observation

The school conducts classroom observation twice every quarter. The head of the mathematics department who is also the school head evaluates performance of teachers, and so the researcher took the same schedule of the class observation. Only one class was observed per day which lasted for a complete period of one hour. The researcher acted as a complete observer and did not participate in the discussion. The class discussion was audio recorded instead of videotaped to respect the preference of the participants. Nonetheless, photos were captured with consent. Comments, observations and highlight of discussion were noted. This type of data collection gave data on how teachers implement their lessons reflecting their understanding of continuity and spiral progression (2^{nd} and 1^{st} research questions respectively).

Collection of Artifacts

Copies of the lesson plan used were provided by the participants. The flow of the discussion together with the assessment was reflected in the submitted lesson plans. Four A's and Six E's were the format used and the lesson plans were detailed or semi-detailed depending on the teachers' preference. Collection of artifacts was not only limited to the lesson plans but also any available curricular documents such as the Curriculum Guide in Mathematics and DepEd memoranda that were substantial to the study. Documents are written evidences that are unobtrusive source of information. The documents provided data on the context within which research participants operated (Bowen, 2009). The documents best show how teachers design their lessons, which is part of the 2^{nd} research question.

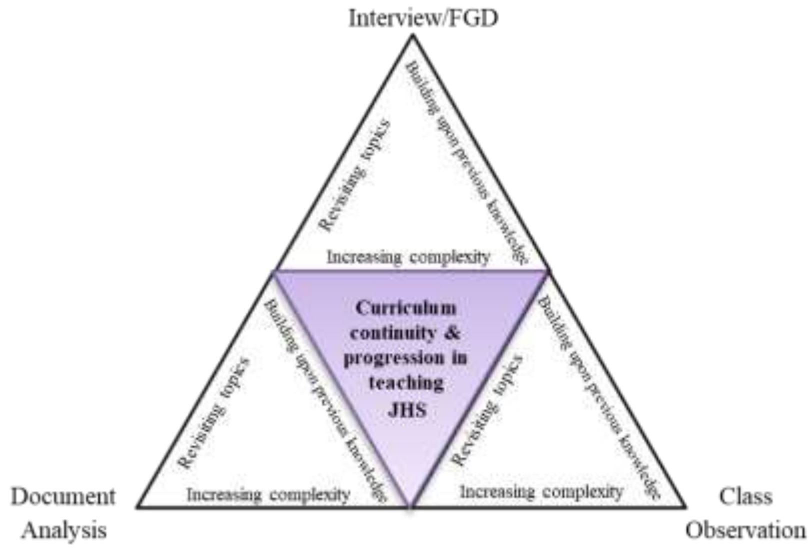
Focus Group Discussion

The focus group discussion was conducted after the individual interview and class observation. The FGD was conducted at the school's Mathematics Center and lasted for one and a half hour. All the ten mathematics teachers joined the focus group together with the department head. The guide questions from validated unstructured questionnaire were flashed one at a time. Depending on the type of question, the participants were asked to write or list their answers on a piece of paper provided to them, or to volunteer for answers. It was audio recorded and saved for later transcription. The FGD helped in validating, confirming and expanding the researcher's understanding that was not directly observed during observations nor present in the documents.

Since multiple data sources were needed to develop a comprehensive understanding of the general aim of this study, triangulation was used. Among the four types of triangulation: method, investigator, theory, and data triangulation, the first type best describes the manner of data collection for this study. Method triangulation refers to the use of multiple methods of data collection to investigate the same phenomenon (Polit & Beck, 2012). Although each data collection process such as the interview, classroom observation, artifacts collection and focus group discussion was conducted to address specific research questions, the convergence of information from these data sources validated the data at hand. A schematic representation of the triangulation design employed in this study is shown in Figure 4.

Figure 4

Triangulated Design for Data Collection

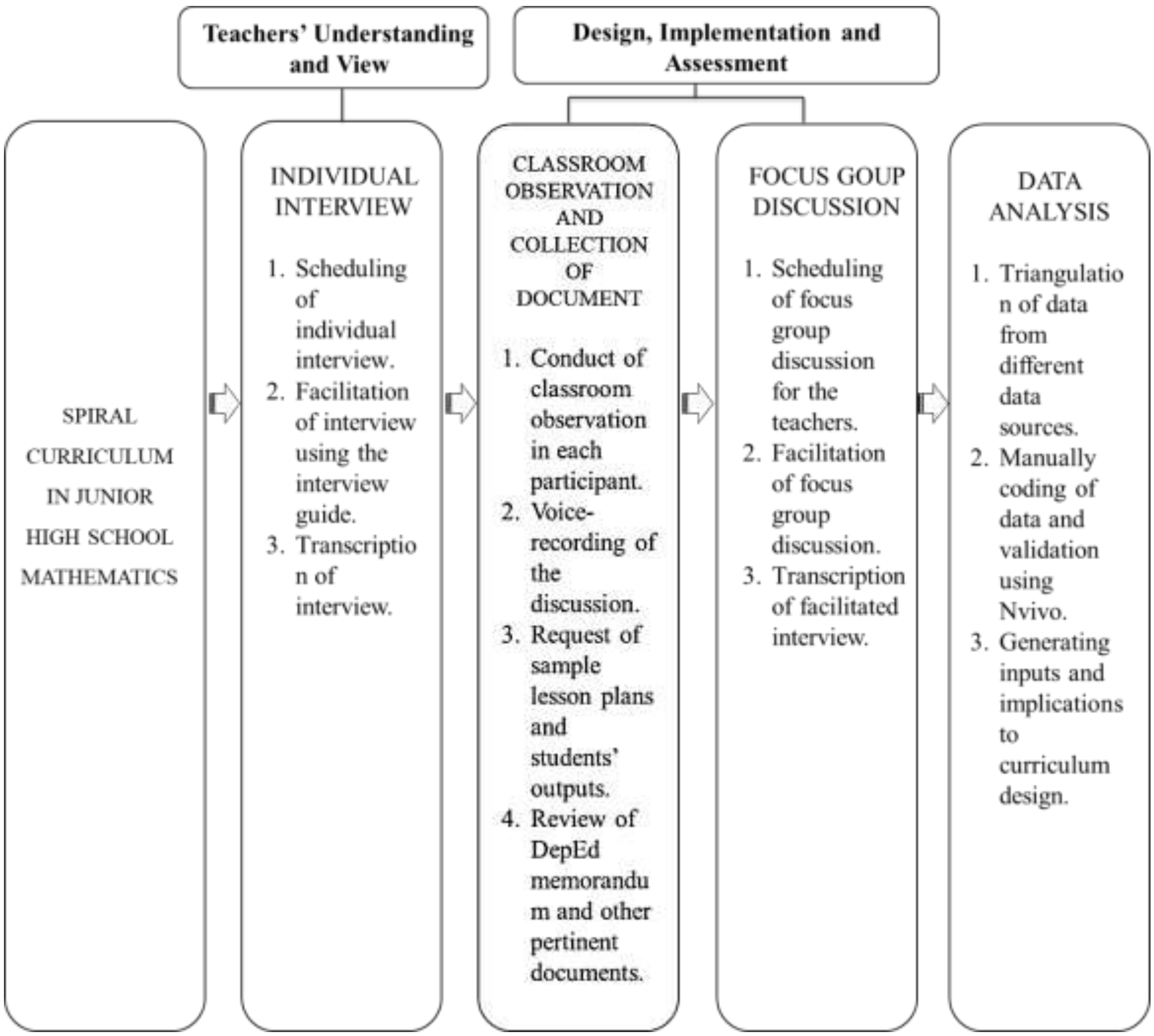


Note: Modified illustration from "The Use of Triangulation Methods in Qualitative Educational Research" by Hoyo and Allen, 2006, *Journal of College Science Teaching*, p. 42. Copyright 2006 by the National Science Teachers Association.

The succeeding figure summarized the plan of action of the study with four main stages including the data analysis. Found in each stages were the steps to which the researcher considered in gathering the information needed.

Figure 5

Research Framework



2.6 Role of the Researcher

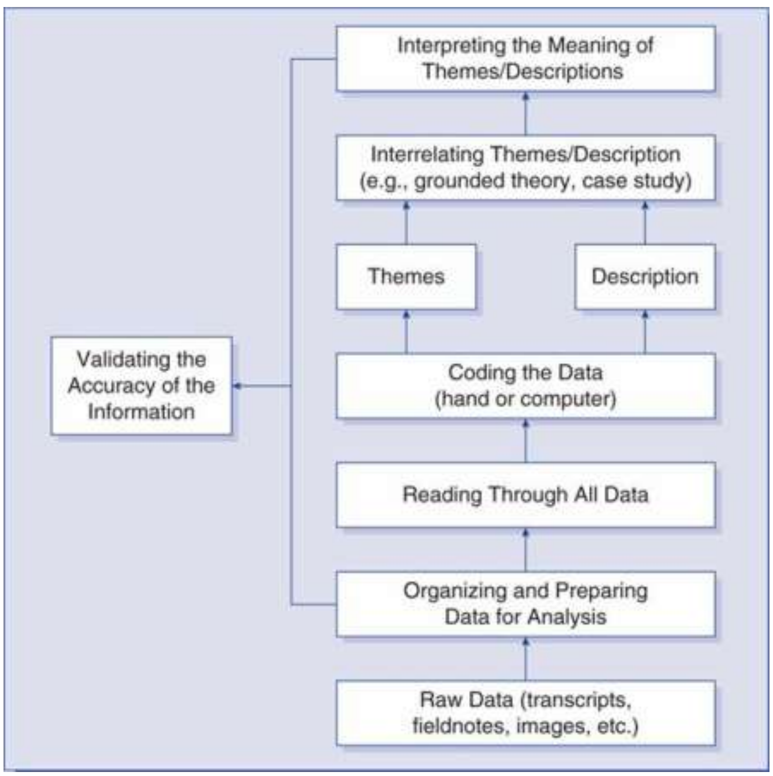
The researcher is the primary data collection instrument in a qualitative research (Creswell, 2014). Her values, biases, personal background and experience in the field of education may shape the interpretations formed during the study; thus it is essential to inform the readers of these potential influences. The implementation of the spiral curriculum began when she already finished her secondary education level. Her bachelor’s degree is on secondary education in mathematics and the concept of spiral curriculum was introduced in her professional subjects. Although the spiral curriculum changes the way the different subject areas in mathematics is being introduced to students, mathematics teachers are less affected than non-math teachers in terms of content. This is because the baccalaureate curriculum in mathematics education covers Algebra, Geometry, Trigonometry, Probability and Statistics, and Calculus and higher maths; hence, student teachers would met the minimum standard required to teach each of these contents. During her pre-service teaching, she had the chance to implement the spiral curriculum and the spiral progression approach followed by a year of formal teaching in senior high school. The fresh and unwary view of mathematics curriculum cultivates her unprejudiced and sensitive view of the topic. Nonetheless, the neophyte experience may bring bias to this study. Though the spiral progression is a powerful approach for learners’ intellectual development, the researcher is concerned to know how teachers ensure continuity and progression in teaching mathematics.

2.7 Data Analysis and Method of Validation

The intent of qualitative data analysis an interpretation is to make sense out of the text (Creswell, 2014). The data from audio records of interviews and FGD were transcribed and organized into files. Upon reading rigorously through all the data, they were then hand coded. Although it was laborious compared to using qualitative data analysis software, hand coding provided opportunity for researcher to familiarize and better understand the responses as she has to go through each line of the text. From these data sources, thematic analysis was employed. Thematic analysis is a form of pattern recognition with emerging themes becoming the categories for analysis (Fereday & Muir-Cochrane, 2006). The generated themes were then verified using NVivo 12 Plus. In using NVivo 12, the research questions served as the 'nodes' and all the relevant data were coded in the nodes. The generated document containing all relevant data aided in verifying the themes previously generated. Figure 6 shows the bottom to top approach to generate themes.

Figure 6

Data Analysis in Qualitative Research (Creswell, 2014)



Note: From "Research Design: Qualitative, Quantitative and Mixed Methods Approaches" (4^{th} ed.) by Creswell, 2014. Copyright 2014 by SAGE Publications, Inc.

The features of spiral curriculum as indicators of how teachers make use of students' previous knowledge were examined from the class discussion and artifacts such as lesson plans, curriculum guide, and DepEd memoranda. Document analysis is a systematic procedure for reviewing or evaluating documents that involve skimming, reading and reviewing (Bowen, 2009). The presence of continuity and progression in teaching the subject in terms of the features of the spiral curriculum such as (a) revisiting topics throughout the school career, (b) building upon previously learned knowledge relating to the new knowledge, and (c) moving from simple to complex task were examined.

Although the process of validation of findings happens throughout the process of conducting the research, Creswell (2014) points out that there is still a need to check the accuracy of the findings in the use of certain procedures. According to Creswell et al. (2000), the validity of a qualitative research relies on the accuracy of findings based on the standpoint of the researcher, the participants, or the readers of an account. Thus, as discussed earlier, triangulation has been the validation strategy for qualitative research. The researcher then triangulated the different data sources of information by examining evidences from the sources (interview, focus group discussion, class observations and documents) and using them to build a coherent justification for themes as suggested by Polit and Beck (2012). This process added to the validity of the study since the themes were established based on converging several sources of data or perspectives from participants (Creswell, 2014).

2. 8 Ethical Considerations

Appropriate procedures in the conduct of the research were considered. The researcher sought an endorsement letter from the school division to implement the study to the selected school. An approval was then requested from the school head and finally to the target participants. A separate informed consent form was given to each participant which included the purpose of the study, the kind of participation solicited, and their rights as participants.

It was emphasized that responses and submitted documents would not be attributed to specific teacher to ensure confidentially. Code names or pseudo names were used in replacement for the true name of the respondents to protect their identity. Only the nature of the school where the teachers came from was described and was not named. The data were stored in secured files and no raw data sharing was allowed to researchers with the same study interest. Data storing was observed strictly.

No monetary collection was involved from the participants and school. As an expression of gratitude for their genuine contribution, the participants and school head received tokens. The instrument validators were given token and/or professional fee. The researcher expressed her willingness to share the result of the study in a roundtable discussion with the teachers and school head. Also, a copy of the study would be given to the school upon request.

Chapter 3

RESULTS AND DISCUSSION

This chapter presents the findings and discussion of how teachers make use of students' previous knowledge to facilitate the current learning based on teachers' understanding of curriculum continuity and progression, designing and implementation of the lesson and assessing students' learning. The data were primarily based from teachers' perception during the individual interview triangulated with document analyses, class observations and focus group discussion. The study involved all the ten mathematics teachers in the junior high school department from the selected secondary public school.

3. 1 Teachers' Understanding of Curriculum Continuity and Progression : Giving a Little of Everything

Bruner describes spiral curriculum as a process of building knowledge based on previously learned information in a spiralling fashion. Thus, in K-12 Math curriculum, competencies are vertically progressing while horizontally integrating the different contents or areas of mathematics. When asked of their definition of continuity and progression, the following are participants' responses:

Teacher 6: *Continuity is the continuous process of whatever the student started since grade 7 until grade 12.*

Teacher 5: *There's an increase (of competencies) and becomes more difficult while the grade level increases in Math. But before they meet that they need competencies taught to them from the previous years.*

The participants describe the continuity of the current curriculum as the presence of common skills, topics or competencies from one grade to another that allows learners to utilize the previous concepts. This is synonymous with the conceptual and operational definition of continuity as used in this study defining continuity as the cyclical repetition of significant features or characteristics of the subject on a regular basis (Bennetts, 2002; Nicolescu & Petrescu, 2014; Owen & Ryan, 2001). Some participants believe that continuity is a continuous process of whatever the students started since their early years of learning. This is parallel to the description of Seameo Innotech (2012) that the K-12 curriculum is designed to have continuum of competencies and standards from primary to secondary levels through the unified curriculum framework.

On the other hand, progression in the curriculum is describe by teachers as the arrangement of topics from simple to complex. According to them, as grade level progresses, there is an added competency that is more difficult. Progression in the curriculum must lead to students' improved learning and they believe that for progression to take place or advance to the next level, students need the previous concepts to catch up with the current lesson. This is in line with Ulep (2013) and Drew's (2020) description of curriculum progression.

Participants perceive that the Math curriculum guide is designed in like manner – continuous and progressive. Examples of topics that teachers find to be continuous and progressive are performing operations and solving equations. Performing operations specifically on signed numbers starts in Grade 7 then grows in complexity in performing operations with polynomials and rational algebraic expressions in Grades 8 and 9 respectively. Equations are also seen continuous and progressive across JHS grade levels as shown in Table 2.

Table 2

Perceived Continuous and Progressive Topics in Math by JHS Math Teachers

Topic	Grade Level	Learning Competency	Code
Performing Operations	7	Performs operations on rational numbers.	M7NS-If-1
		Perform operations on polynomials.	M7AL-II-e-2
	8	Performs operations on rational algebraic expressions.	M8AL-Ic-d-1
	9	Simplify expressions with rational exponents.	M9AL-IIe-1
Equations	7	Solving linear equation in one variable.	M7AL-IIi-1
	8	Solves linear equations in two variables.	M8AL-Ig-2
	9	Solves quadratic equations	M9AL-Ia-b-1
	10	Solves polynomial equations.	M10AL-Ij-1

Source: K-12 Mathematics Curriculum Guide (2016)

In summary, participants describe how the learning seems to be in a spiral curriculum, and that is giving “a little of everything” to students. This is because they have to introduce the concepts bit by bit where the depth of the discussion is controlled by the learning objectives. The contents undergo the cycle of cut-continue: cut the lesson to give way for the next area of mathematics (Algebra, Geometry, Statistics and Probability) then continue “a bit” of the lesson again next year and so on. This is one of the features of spiral curriculum: revisiting topics.

Teachers seem to be aware and display comprehensive understanding of the continuous and progressive nature of the K-12 math curriculum as evidenced by their responses. Their understanding plays significant role on how they view the curriculum. Participants’ views are discussed in the next section.

3.2 Teachers’ View of Continuity and Progression in JHS Mathematics

It can be noted that the participants’ understanding of spiral math is aligned with the theoretical and conceptual idea of what spiral curriculum is. However, results from interviews and focus group discussion revealed that they generally expressed negative views on the outcome of spiral curriculum in math.

Focusing on the continuity and progression, their views were categorized into four themes: discontinuity of instruction and students’ learning, non-mastery of mathematics content, choosing between quality of learning and quantity of competencies, and contrasting impact and effect to diverse types of learners.

Discontinuity of Instruction and Student' Learning

Although the participants perceive that the curriculum reflected in the curriculum guide is designed in a continuous and progressive manner, there are some concerns when it comes to teaching and students' learning. Dividing the topics and/or sub-topic and distributing the content areas throughout JHS level were seen as strong ground for discontinuity in instruction and students' learning because the topics from the five content areas are "chunked" and distributed throughout the junior high school level, as Teacher 3 explained.

Teacher 3: There is no continuity of their knowledge, with regards to that specific discipline because we have to move-up, to cut and move to another area of discipline.

This has created a momentary cutting of discussion in order to give way to the next sub-topic from the same or different content area (e.g. from Algebra to Geometry). Likewise, students have to stop studying a particular topic and continue it in the next grade level. With this "chunking" of math content topics, some teachers perceived weak connections among mathematics contents across grade levels, while others have difficulty relating and bridging competencies within the grade level, as expressed by Teachers 8 and 9.

Researcher: How were you able to relate the lessons before in Grade 7 and your lessons now in Grade 9?

Teacher 9: What I see in Grade 7 has nothing to do with Grades 8 and 9, because it is spiral, in the sets…no continuity of lesson. And also the foundation is very *poor…even though they are just in signed numbers they still don't know how to add, how to get the absolute value, and what sign to use. Some say maybe their foundation is too (weak)…because supposed to be we are not anymore on the foundation.*

Teacher 8: *The lessons are connected. The problem is on how to insert…*how to start. *After the sequences, I will start with polynomials. And in polynomials I will again start with the basic: mono, bi, tri when in fact those were the lessons in Grade 8 especially the factoring. We have problems in factoring.*

Bridging concepts requires revisiting. However, revisiting of concepts becomes a rigid process for the teachers and students. According to Ambrose, et al. (2010), connecting lessons do not come easily for students. Teachers should not assume that students will draw on relevant prior knowledge at an instant; instead, they should deliberately activate students' prior knowledge to help them create links to new knowledge. That is why teachers would patiently allot time to review the prerequisites because they cannot proceed with the more complex lesson. However, deliberately activating students' prior knowledge takes time and taking too much time might lead to unfinished the curriculum creating another problem to learning continuity and progression.

The following are the specific topics in Mathematics that the participants regarded as discontinued. First, Math teachers observed discontinuity of Probability and Statistics, specifically on sets. According to some participants, there is no follow up lesson of Sets in other grade levels.

Teacher 2: *For example, you have discussed sets in grade 7 then it will be continued when the students get in the 10th grade. Meaning to say, even though from basic it will become now complex (for grade 10)…but there exist a gap on the part of the lesson. Oh, where is the continuity there of the topic (sets) when in fact it is not found in grades 8 and 9? In other lessons, it is continuous.*

This is similar with the findings of University of Melbourne as presented by Corpuz (2012) that there is reasonable continuity in the Mathematics curriculum except in Statistics and Geometry. Further, they found Statistics to be discontinuous and the materials are not well sequenced. Table 3 shows the perceived discontinued Math topics.

Table 3

Perceived Discontinued Topics by JHS Mathematics Teachers

Topic	Grade Level	Learning Competency	Code
Sets	7	Illustrates the union and intersection of sets and the difference of two sets.	M7NS-Ia-2
	8	Illustrates an experiment, outcome, sample space and event.	M8GE-IVf-1
	10	Illustrates events, union and intersection of events.	M10SP-IIId-e-1
Operations on Polynomials	7	Adds and subtracts polynomials.	M7AL-IId-2
	7	Multiplies and divides polynomials	M7AL-IIe-2
	10	Performs division of polynomials using long division and synthetic division.	M10AL-Ig-1

Note: From K-12 Mathematics Curriculum Guide (2016), pp. 168-214.

Analysis of the Math Curriculum Guide shows that lessons on Set is not explicitly found in Grade 9; nonetheless, its concept is applied in quadratic equations, inequalities, functions, and rational algebraic equations in Grade 9 (e.g. describing the solution set). Thus, Set concepts are still present in Grade 9 topics. Set falls under Patterns, Functions, and Algebra which is formally introduced in Grade 7, reinforced in the succeeding years until mastered in Grade 10 (DOST-SEI & MATHTED, 2011).

In addition to Set, Math teachers believe that the long and synthetic division (code: M10-AL-Ig-1 in Grade 10) is placed too far from the basic polynomial operations (Grade 7); and even worse, the preceding competency which is solving problems involving sequences (M10AL-If-2) is not even a prerequisite skill for long , as explained by Teacher 8. This is one of the gaps observed by the teachers- - sometimes the previous lesson does not serve as a prerequisite topic for the next lesson. The lesson for the day is neither close nor related to the lesson the previous day. However, just like Set, formal introduction of polynomials begins in Grade 7 and is expected to be mastered in Grade 10. Referring to Math CG of Grades 8 and 9, competencies such as factoring, simplifying expressions, and solving equations require application of basic operations of polynomials. Thus, the basic operations on polynomial are practiced and reinforced in Grades 8 and 9 in preparation for long division in Grade 10. Therefore, there is continuity of skills.

Bruner argued that for effective “transfer” to happen, a greater emphasis must be drawn to finding connections among different experiences in learning rather than focusing on mastery of facts. To achieve this, teachers must provide guidance to students as they learn through enquiry by identifying what prior knowledge students have and utilize them in the formation of new knowledge. Based from their responses, some teachers missed to acknowledge the application of some competencies to another thereby perceiving discontinuity of topics. Explaining the connection between the mathematics concepts is a powerful tool of teachers to achieve continuity of concepts. According to Attard (2010), it is necessary for the mathematics teacher to get familiar with the content at least for the adjacent years. In Rome, secondary students experience inconsistent academic progress in mathematics because connecting the previous knowledge to the on-going classroom experience is not part of their learning strategies in mathematics (Nicolescu and Petrescu, 2014). There have been studies recording inconsistent academic performance of students in mathematics, and this study reveal gaps in acknowledging continuity among math competencies.

Poor Mastery of Mathematics Content

Almost all of the teacher-participants expressed consistent sentiment that K-12 students have poor mastery of mathematics content due to poor knowledge retention, underdeveloped prerequisites or poorly taught topics. The poor mastery of content makes them difficult to advance to more complex task, although teachers find the competencies age appropriate for them. Students tend to have no focus and are confused with the areas of the subject. Their knowledge in the areas of mathematics is perceived to be weak. As Orbe et al. (2018) said, unfocused, extensive and challenging remain to be the biggest impediment of spiral curriculum.

Operations on signed numbers, a foundation topic whose application is found in the entire course of Math, is the most cited poorly mastered topic by the participants despite being revisited from Grades 7 to 10. Because of this, participants observed that continuity of topics and mastery of subject matter among students is better in the disciplined-based approach than in spiral. The continuity and progression of competencies is horizontal rather than vertical that allows immediate recall and application of skills helping them better retain the lessons. Learning is more focused, concentrated and less confusing because the content is the same. Teachers 4 and 7 expressing comparison between BEC and K-12 Math curriculum:

Teacher 4 : *Honestly, when it comes to mastery of the topics, the approach of BEC curriculum is much better.*

Teacher 7: It is spiral approach and students have little knowledge about Algebra, Geometry, and Statistics where in that is also from elementary years…where in for me there is no mastery on the part of the students. Because it is bit by bit.

Along with mathematics, science curriculum also uses spiral progression approach and yields similar result. Knowledge retention and non-mastery were also the top problems of science teachers (Samala, 2017) and changing of the subject area quarterly has resulted to lack of depth, lack of concentration and a very minimal focus on each area (Orbe et al., 2018), the same with how the participants observed and experienced.

It can be noted that the government recommended to use the spiral progression approach to ensure mastery of knowledge and skills after each level (RA 10533, Sec. 10);

but after years of implementation, implementers such as the participants, have perceived it otherwise. The poor mastery of mathematics content is attributed by the participants to the spiral progression approach and congested competencies. This study has added another notch that poor mastery of content is still prevalent using the spiral approach.

Choosing between Quality Teaching and Quantity of Competencies

Participants' define teaching in the spiral curriculum as "giving a little of everything". This is a similar concept of "mile-wide, inch-deep" approach of US. United States implementing spiral mathematics has been criticized for using the spiral approach tagged as "inch deep and mile wide" mathematics instruction because students are left with little knowledge to cover more topics (Duffrin, 2005).

The conceptual framework of the K-12 Mathematics Education is grounded in student-centered theories and principles such as Experiential and Situated Learning, Reflective Learning, Constructivism, Cooperative Learning and Discovery and Inquiry-based Learning (K-12 CG, 2016). Mastery of content is better achieved through these principles and theories. However, the dilemma of using student-centered activities is time-consuming and unpredictable (Alexander, 2000) which is also true for the participants.

In the study, teachers are torn between quality of teaching and quantity of competencies. It turned out that when teachers consider quality in teaching, they most likely will not finish the curriculum affecting the continuity of topics. On the other hand, covering all the intended topics will result to superficial learning, thereby affecting the learning progression of students.

The following are factors why teachers have difficulty in keeping with the curriculum:

1. Congested competencies
2. Class suspensions and interruptions
3. Cycle of unfinished curriculum

Congested competencies. Teachers find it important to finish the curriculum. However, they perceive that mathematics competencies are too broad and very congested. They think that there are so many competencies per grade level and that they feel pressured. Sometimes they have to rush that some topics are not discussed properly. One teacher admitted that most of the time her classes are not able to touch Trigonometry topics. She just gave a summary of important concepts that students would need for the next grade level.

Teacher 5: There are so many competencies that are given per year. So it seems that the competencies are not attained. It is more on quantity than quality.

Having a lot to teach, and then re-teaching to fill in the learning gaps result to curriculum crowding (Drew, 2020). Therefore, their experiences are in contrast with the claim that K-12 is a solution to decongest the curriculum. Problem on decongesting the curriculum still exists in spiral curriculum.

Class suspension and interruption. This has been a long-ran issue of teachers why they cannot finish the curriculum on time especially in the Bicol Region – the home of typhoons. The region seems to host series of natural disasters. Albay, where the study was conducted, is demographically disadvantaged when it comes to natural disturbances like volcanic eruptions and typhoons. A number of class suspensions brought by natural calamities are recorded in the region. From June to December 2019 alone, there are at least 10 days, equivalent to two weeks of classes, of suspension due to heavy rains and typhoons (See Appendix O, p. 199). There had been cases when class suspensions in Albay lasted for more than a month; yet, the rural schools followed the national prescribed curriculum and underwent the same national assessments.

Aside from inevitable class suspensions caused by calamities, school related activities become factors as well for the delay of discussion. Participants think that DepEd had planned well the amount of competencies spread in 200-220 days (RA 7797), but missed to consider class interruptions that might be brought by curricular and co-curricular activities which the same office mandates. DepEd Order 7, s. 2019 contains a long list of celebrations or observances which are integrated as co-curricular activities for school year 2019-2020. Programs, ceremonies and gatherings are conducted alongside, which means prevalent class interruptions.

Cycle of unfinished curriculum. The cycle of unfinished curriculum is one of the predominant problems of the participants where the two aforementioned factors significantly contribute. According to them, they need to tackle first the uncovered competencies, which were supposedly covered and given to students. With this, they stayed long in the review, which affected the terminal topics, leading to unfinished curriculum at the end of the school year. When asked what happened to uncovered competencies, they said it is up to the next math teacher to include them. Most probably, the next teacher will tackle the uncovered competencies from previous grade level in order to fill the gap, thereby creating a cycle of unfinished curriculum. In 2018, the school participated in the Metrobank-MTAP DepEd Math Challenge where their Grades 7, 8, 9 and 10 students got very low scores. It was found out that they were far behind against the expected competencies.

With this, keeping the quality of teaching without compromising the quantity of competencies has been a challenge for teachers. Both bore respective disadvantages to students and teachers. Teachers are advised by their head and supervisors to consider the quality of learning and at the same time finish the competencies but seemed to be impossible for teachers considering the current situation.

Contrasting Impact and Effect to Different Types of Learner

Because of the complex nature of spiral curriculum, teachers believe that the impact and effect to students vary. Out of 40 sections or classes, the school has 4 STE classes, one per year level, approximately 10% of the population of JHS students in the school. An STE class is a group of students with homogenous abilities, usually the cream of the crop. The rest is heterogeneous group of students – average to struggling students. They believe that spiral curriculum is "pro" to STE classes, but a menace to the rest of the group.

As teachers observed, the impact of spiral mathematics is good for fast learners because they can recall past lessons easily. A little guidance from them make the students easily apply previous concepts to complex tasks, especially those who are inclined in the subject and self-directed. Using discovery or exploratory approach does not consume so much time when compared to slow learners. According to a participant, it seems that spiral mathematics complements the maturity of the cognitive aspect of fast learners. As a result they tend to advance more in the subject.

Meanwhile, slow learners are drag behind. They have poor retention span and have a hard time recalling what have been taught in the past, much more in applying them to complicated tasks. This is the reason why teachers have to spend ample time for review for students to cope. They need a great amount of time for scaffolding. Greater effort is required. As teachers see it, students have underdeveloped prerequisites and moving to complex competencies makes the situation “pitiful” for them. As a result, instead of building up their knowledge, the more that they are confused and burdened. The struggle is felt more conclusive both by students and teachers in higher grade levels. In the focus group discussion, they were ask to rate the extent of success of learning Math with continuity and progression: 1 being not at all successful and 5 being very successful. Eight teachers gave a middle rating of 3, one gave a rating of 2 while two teachers were undecided if 3 or 2. The top most identified factors for teachers are knowledge retention and mastery exacerbated by “mass promotion”.

In conclusion, the current curriculum approach in teaching Math is perceived as not effective to all types of learners. For them, it is effective to fast and self-directed learners, but not to slow and struggling ones. Considering that there are more slow learners than fast learners in a classroom implies its effect to greater whole. One teacher remarked that it seems impossible to meet the standard that the curriculum intends. For math teachers, it would be better if the curriculum is not spiral. Below are some of the teachers’ sentiment and comparisons.

Teacher 5: *In spiral progression…it is applicable to higher sections only because they really remember…the lessons are retained. But for example for lower sections, it would be better if it is not spiral…just like before (BEC).*

Teacher 7: *In the curriculum it is okay. The topics are really progressive but when it comes to implementation the level of learners matter. It seems that you can't meet the standard that the curriculum wants in making the learning of the student progressive as well. The curriculum is good because it is continuous but seems like it is not effective to the students.*

3.3 Design, Implementation and Student Assessment through the Key Principles of Spiral Progression Approach

Their understanding on curriculum continuity and progression where corroborated with their classroom implementation. Factors affecting the continuity and progression of math curriculum were identified along the way which are discussed in this section. The aim of the study is to explore how teachers make use of students' previous knowledge to facilitate current learning. Hence, the lesson design, implementation and student assessment were vital to determine the process. The continuity and progression of the mathematics curriculum were examined through the key principles of spiral approach, such as (a) revisiting topics throughout the school career, (b) building upon previously learned knowledge relating to the new knowledge, and (c) moving from simple to complex task.

Designing the Lesson

Revisiting Topics. Bruner's idea of spiral curriculum is the continuous exposure to the topics previously learned which has something to do with the new lesson. Thus, teachers must have a clear picture in their minds of the knowledge requirements of the new task and assess both the amount and nature of students' prior knowledge. The knowledge requirement is indicated in the lesson plan objectives (see Appendix K, p. 173). Teachers identify the prerequisites needed for the lesson. The recapitulation is usually in the "Opener" of 4As and "Engage" of 6Es instructional model. The participants are using either 4As or 6Es models for their daily lesson plan/log. All the participants conduct review every lesson.

Teachers consult the K-12 mathematics curriculum guide in identifying the competencies. According to them, they are mandated to follow the guide and as much as possible not deviate from it. They called it as the "heart of making a plan" and their "bible" in teaching.

Building upon Previously Learned Knowledge Relating to the New Knowledge. The Grade 7 students of Teacher 2 were first given preliminary activities on division which is essential in expressing rational numbers from faction form to decimal form (see Figure 7 from Appendix K, P. 173). The skill in dividing numbers is crucial to correctly express fraction to decimal number and these topics are taught in primary education. Students' concept about division, fraction and decimal serve as their previous knowledge. These concepts were utilized by Teacher 2 in her lesson plan to help students understand rational number and distinguish rational number from non-rational number. According to Drew (2020), the revisiting of topics should not be just a mere cyclical repetition of topic; rather, it must utilize the previous concept studied in the formation of new knowledge so that they build from their foundations rather than starting anew. This was evident in the teacher's plan. An excerpt of her class discussion is found under the Implementation section.

Some of the participants guided the students to relate the previous knowledge to the new objective through preliminary activities, drills, brainstorming and assignments.

Figure 7

Preliminary Activity Given to Students (Teacher 2, Grade 7)

B. LESSON PROPER

A. ACTIVITY I

The class will be divided into 3 groups. Each group will be given a task to do. One of the members will present their work in front of the class.

GROUP 1 (FOLLOW ME)

Given the example below on expressing fractions to decimal number, please follow the steps to express $\frac{3}{20}$, $\frac{5}{8}$ and $\frac{6}{15}$

1/5	6/8	9/8
$5 \overline{)1.0} = 0.2$ 10 0 Therefore, $\frac{1}{5} = 0.2$	$8 \overline{)6.00} = 0.75$ 56 40 40 0 Therefore, $\frac{6}{8} = 0.75$	$8 \overline{)9.000} = 1.125$ 8 10 8 20 16 40 40 0 Therefore, $\frac{9}{8} = 1.125$

Moving from Simple to Complex Task. Usually, the preliminary part of every teachers' lesson plan is easy; but as the students get engaged with the lesson, the teacher prepare the students for more complex and complicated task. Among the documents collected, this feature was shown by Teacher 8 in her lesson plan (see Figure 8).

Figure 8

Example of Teacher's Plan in Learning New Skill (Teacher 8, Grade 10)

		ENGAGE	Find the missing terms in each geometric sequence from the box below. 1. 3, 12, 48, ___, ___ 2. ___, ___, 32, 64, 128, ___ 3. 5, ___, 20, 40, ___ 8 -2 16 -80 768 80 -8 192 1/2 10 Students will be called to answer on the board and the others will be waving their hands whenever the answer is correct.
	A.	Reviewing previous lessons or presenting the next lesson	
	B.	Establishing a purpose of the lesson	Sometimes, we are given two terms of a geometric sequence, but they are not consecutive terms.
	C.	Presenting examples/instances of the new lesson	Geometric means are the terms between two given terms of a geometric sequence. Examples: 1. 3, 12, 48, 192, 768 2. 8, 16, 32, 64, 128 3. 5, 10, 20, 40, 80

In Figure 8, under Engage (A), one of the teachers planned to present first their previous lesson (finding the last terms in a geometric sequence). Later on she challenged the students to find the terms in between two terms, in a geometric sequence. This lead to the discussion of a new topic, Geometric Means. Harden and Stamper (1999) define increasing complexity as a successive level of difficulty when topics are visited characterized by new objectives and fresh learning opportunities towards the final overall objectives. From finding the end terms in geometric sequence to finding the geometric means, the lesson showed an increase in complexity. The topic have more advanced applications and is at a deeper level (Drew, 2020). Another example is in Figure 9. The new skill in Figure 9 requires manipulating the formula from the general rule to get the n^{th} term in a geometric sequence.

Figure 9

Example of Teacher's Plan in Learning New Skill (Teacher 2, Grade 10)

A. ENGAGE:	
1. Reviewing previous lesson/Presenting the new lesson.	**A. Priming Activity** • Prayer • Checking of Attendance • Motivation/Recall **(I'LL TELL YOU WHAT YOU ARE, OK?)** State/give what is asked in the following questions. a. It is a kind of sequence with a common ratio. b. What letter is used to represent the common ratio?. c. It is a symbol used to represent the first term of a sequence. d. What does a_n represent? e. What is the general rule of a geometric sequence?
3. Presenting examples/instances of the new lesson	** What is the 10th term of the geometric sequence 8, 4, 2, 1. . . ? Solution: $a_n = a_1 r^{n-1}$ $a_1 = 8$ $a_{10} = 8(1/2)^{10-1}$ $r = ½$ $a_{10} = 8(1/2)^9$ $n = 10$ $a_{10} = 8(1/512)$ $a_{10} = ?$ $a_{10} = 8/512$ $\mathbf{a_{10} = 1/64}$

The documents presented by the participants show that there is a movement from simple to complex competencies and skills. Among the samples collected, the three features were evident. This study also documented how these plans were put into practice by the participants and further solicited their implementation experiences.

Implementing the Lesson

Revisiting Topics. Teachers spend a couple of minutes for review and the fast way for them is by asking questions or posing a problem. This allows them to get immediate judgement if the prerequisite skills have been discussed and mastered by the students, or whether some misconceptions exist. According to the participants, revisiting topics is not a problem when the topic is simple and students have good memory retention; but when a large number of class population have poorly mastered or forgotten the prerequisites, this poses immense problem for teachers and to the current lesson itself. The latter happens in most cases when they stay long in reviewing previous lessons. Sometimes the review tends to be their lesson for the day, thus the lesson becomes repetitive especially in the lower section. According to the participants, no matter how well they planned their lesson, sometimes they cannot implement it the way it was planned. They have to consider and address the immediate needs of the students.

In the study of Incebacak et al., (2016), teachers view that the spiral approach is structured constantly to transfer information and does not give the students the opportunity to review. However, in this study, teachers expressed frustration on the unending review of prerequisites because sometimes they have to start from the basic. This experience of the participants confirm the claim of Capangpangan (2015) that it is very much dragging to reintroduce the past lesson for the present lesson be achieved. Most of the time the class becomes a review center, reviewing the previous discussions with no progression to the next competency.

Building upon Previously Learned Knowledge Relating to the New Knowledge. After recapitulation is the lesson proper. In this stage, building up of knowledge takes place. In one of the classes observed in Grade 10, the new competency is finding the n^{th} term of a geometric sequence. This requires manipulating and later on deriving a formula. The teacher posed structured questions and examples as scaffolds that guided the students in manipulating the formula, beginning from recalling the general formula of a geometric sequence, and identifying the given and substitution while fixing to reach the goal of finding the n^{th} term. Scaffolding is the supports that teachers provide to the learners during problem solving in a form of hints, reminders, and encouragement (Shepard, 2005).

Another instance is Grade 7 class. From the preliminary activity of the teacher in Figure 7 (p.50) such as expressing fractions to decimals, students' knowledge and skill in division were elicited. This was emphasized in the activities and probing questions prompted to students below.

Teacher: *Based on our activity, how did you express fraction to decimal number? What did we do?*

Student: *The formula is numerator divided by denominator.*

Teacher: *What operation did we apply in expressing fraction form to decimal form?*

Student: *Division.*

In the priming activity, rational number is defined as any number that can be expressed in the form of a fraction (such that the denominator is not zero). It will be easy for students to identify a neat fraction as a rational number but not decimal numbers. At the end part of her lesson, the teacher mentioned about terminating and repeating decimals as examples of rational numbers.

In a post-interview with the teachers, Teacher 1 planned to conduct follow-up lesson the next day because she felt that students need more enrichment exercises. On the other hand, Teacher 2 said her class had a smooth transition from past lesson to current lesson because the topic was simple and the students were in the higher section. She thought of introducing the next competency the next day. Based on the participants' experiences, the perceived factors affecting successful building of previous knowledge were the complexity of topic and students' prior knowledge. Complex topics require more prerequisites. When students have poor mastery of content or prerequisites are poorly taught to students in early years, it will be difficult for students to build from their prior knowledge. Bruner has emphasized this in his 2nd key feature of obtaining new knowledge form what students have previously learned. Meanwhile, studies in the country revealed that students have poor knowledge retention and mastery (Braza & Supapo, 2014; Resurreccion & Adanza, 2015; Capangpangan, 2016). This implies that building new knowledge from previous knowledge will be hard to attain.

One strategy that teachers employ is called Mastery Teaching described by Teacher 6 and 5. A student does not move on until they have mastered the topic but getting stuck in a particular topic is one of the risks of mastery teaching (Drew, 2020).

Teacher 6: *I am not continuing my lesson unless the students learn this specific topic because it is useless to continue if there is no learning that takes place in my students.*

Teacher 5: *If they fail in the review, they cannot advance to the next.*

Moving from Simple to Complex Task. Teachers observe that as the topics are getting more complex, students' performance is getting low. In the focus group discussion, participants revealed that there is progression if the mathematics curriculum guide will be the only basis; but in the implementation and students' learning, there is no progression. According to Bruner (1960), in the case that the students have successfully connected the previous and present knowledge or skill, this brings a new level of formal or operational rigor and a broader level of abstraction and comprehensiveness to students (Bruner, 1960). Since the participants in this study perceived that most of their students perform poorly on this aspect, to which several studies in the country likewise confirm, this means that there is a problem with students' learning progression.

Teacher 7: *In the curriculum it is okay. The topics are really progressive but when it comes to implementation the level of learners matter. It seems that you can't meet the standard that the curriculum wants in making the learning of the student progressive as well.*

Assessing Students' Learning

This section focuses on the assessment given by the participants to the students in planning and implementing their formative and summative assessments.

Revisiting Topics. It is important to carefully plan the assessment in order to capture the objectives. One of the participants did not just jump to the main objective of her lesson (finding the n^{th} term in a geometric sequence); rather, she deliberately included knowledge-activation items in her assessment tool to lead the students in successfully solving for the n^{th} term such as identifying a_1 and r as shown in Figure 10. Students were prompted to elicit prior knowledge. In this case, students were made aware of the continuity of the skills.

Figure 10

Revisiting Topic in Assessment Tool (Teacher 1, Grade 10)

E. EVALUATE:	
1. Evaluating learning	*******Directions***: Read each item carefully and encircle the letter of the correct answer.** A. Given the geometric sequence 2, 4, 8, 16.... 1. What is the value of a_1 ? a. 2 b. 4, c. 8 d. 16 2. What is the common ratio ? a. 4 b. 3 c. 2 d. 1/2 3. Find the 7th term a. 64 b. 32 c. 256 d. 128 B. If a geometric sequence has a_1 = -3, and r = 2, 4. Find the 5th term a. -24 b. -48 c. -12 d. -36 5. What is the value of n in #4? a. 2 b. 3 c. 4 d. 5

Building upon Previously Learned Knowledge Relating to the New Knowledge. Aside from clear concepts on geometric sequence, the skills needed to find the n^{th} term are manipulating and deriving a formula from the general one. In Figure 10, items in A are the foundation to answer successfully the fourth test item found in B. How the teacher designed and implemented her assessment was a clear concept of scaffolding implemented in the assessment.

It is noticeable, however, that participants gave very few formative assessment items, which in some class observations were not finished. This resulted to follow-up sessions for enrichment; thus, a lesson may cover two days to give students ample time to build up knowledge.

Moving from Simple to Complex Task. Items 1 and 2 in Figure 10 where students are asked to find a_1 and r are under Remembering and Understanding of revised Bloom's

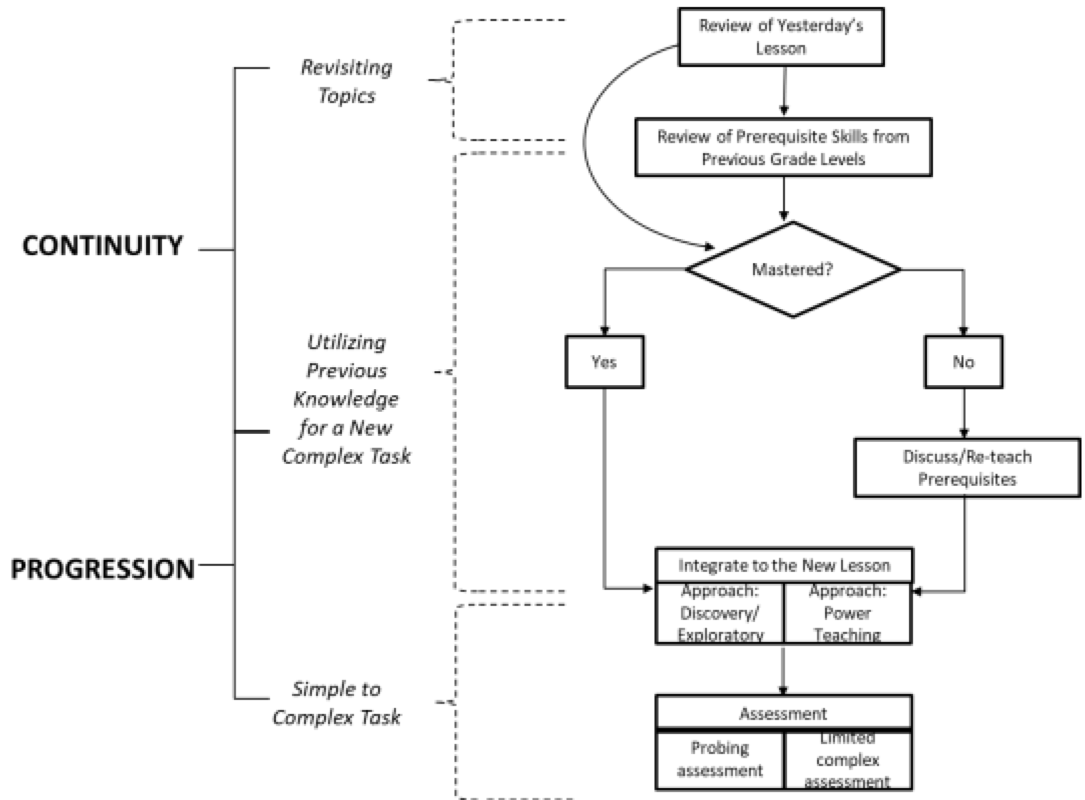
Taxonomy. Items 3 and 4 are in the Applying level. The students have to solve by substituting the given to the formula. This shows movement from simple to complex task. However, on the last item, the skill reverted to Remembering and Understanding. Problems indicating higher levels of revised Bloom's Taxonomy, such as finding or deriving the formula in finding n, a_1 or n, could have been given to extend students' thinking even if the objective is only finding the n^{th} term. However, according to the particiants, they could not give complex activities to students for the fear that they might not finish the lessons on time. Adding probing activities to extend students' learning is sometimes not possible due to limited time and students' ability. Constructing a firm foundation in the minds of the students takes time (Cowles, 2018).

The revisiting of topics, building up of knowledge and movement from simple to complex task are all apparent in formative assessments. Among the three features, the movement from simple to complex task is explicit in summative assessments. This is evident in terms of the covered competencies in the quarterly exam. The school gives uniform quarterly assessment for each grade level. Hence, teachers handling the same grade level coordinate with each and adjust in order to cover the same amount of competencies. The K-12 curriculum guide suggests the amount of competencies needed for each quarter, however, this is not always followed due to some intervening factors.

The summary of the planning, implementation and assessment, and the relationship between continuity and progression in the mathematics curriculum through the three principles of spiral progression approach is illustrated in Figure 11.

Figure 11

Relationship of Continuity and Progression



Bruner's three stages of human cognition merged with Vygotsky's zone of proximal development is what Bruner terms as Spiral Curriculum (Clabaugh, 2010). Bruner's three key principles of spiral curriculum as implemented in the classroom is illustrated in Figure 11. The revisiting topics usually comes first before the lesson proper but is sometimes embedded along the discussion. When students' prior knowledge has been activated, teachers help the students to link prior knowledge in the formation of a new one through scaffolding. Successful acquisition of new knowledge indicates an added learning needed for complex tasks. Nonetheless, there are two faces of implementation.

The left side of the figure reflects a smooth continuity and progression of mathematics curriculum in a classroom while the right side shows the complex responsibility of the teachers when students have underdeveloped skills. The left side shows the ideal curriculum implementation where students can successfully linked previous knowledge in understanding the current knowledge. To have a solid foundation of continuity, it should ensure that learner's prior learning is built and connected upon the next course of study (Butt, 2002)

The figure also illustrates the relationship between continuity and progression. It shows that continuity is essential to achieve progression. For progression to be achieved, there has to be continuity (Chapman, 2002). This further implies that the quality of continuity in the curriculum and its implementation predicts the quality of progression. Meaning, the quality of students' learning progression comes from the strong continuity between the previous and current knowledge. Meanwhile, discontinuity in the curriculum brings slow or no progression at all.

Focusing too much on continuity may result to repetitive curriculum. On the other hand, compromising the continuity for progression may lead to superficial learning. The participants' view that progression in the curriculum preferred more often preferred because the School Division can easily monitor progression. Below is an excerpt from the FGD.

Teacher 1: *If you follow the curriculum guide, the one that is given more focus is the progression.*

Teacher 11: *Continuity but no progression. They don't understand, so there is continuity but no progression in learning.*

As solution to unfinished curriculum caused by congested learning competencies, teachers make Budget of Work (BOW) and use power teaching. In making a BOW, teachers ‘unpack’ the broad competencies and ‘budget’ their time. Teachers within particular grade level decide for the budgeting. Ideally, it should be made before the start of the school year as it serves as a budget plan for the year; but teachers make BOW only if it is deemed necessary, especially if they are already left behind with the lessons. To budget their time well, teachers are using power teaching. As defined by teachers, power teaching is simplified approach in teaching with limited complex students activities. That is, more topics with lesser activities. Teachers lessen student-centered approaches to save time. Other participants described it as back to traditional way of teaching and spoon feeding just to save time and cover more topics. They choose activities and sometimes omit some without affecting the objective. Another recommendation is made by Teacher 8.

Teacher 8: *That is why we are told to make BOW just to “shoot” all of those (competencies). Then the advice to us is to simplify the form of activities. Not all types of activities should be given to students. There are activities you can omit without compromising the objectives. For example, if you can give it in one day, just do it in one day. Limit activities so that you can cover all the competencies and objectives.*

The school also conducts class observation and attends Learning Action Cell together with other math teachers under the same division. When needed, they conduct remedial or make-up classes to cover the remaining topics. There has been an instance where the school conducted a special seminar-type session for senior high school students because more than one class has uncovered topics in the subject. But the discussion was not comprehensive as compared to a regular class.

3.4 Inputs and Implications to Mathematics Curriculum Design

Based on the participants' understanding, views and process on designing the lesson, implementation and assessment of students' learning, the following are suggested inputs to curricular design of junior high school mathematics.

Decongesting the Curriculum

The mathematics content was viewed as congested with broad learning competencies. Teachers felt that some of the activities in the learning modules are repetitive and that there could be competencies which could be merged. The additional two more years in the basic education was considered one solution to decongest the curriculum. However, a closer comparison of 2002 BEC and K-12 curriculum reveals not a decongestion, but a reduction of instructional hours (Philippine Basic Education, 2015). Figure 12 shows the comparison of the learning areas and time allotment of the two curricula copied from the K-12 Toolkit of Seameo Innotech (2012). From 5 hours per week, the time allotment for Math was reduced to 4 hours per week.

Figure 12

Comparison of the Learning Areas and Time Allotment of the Secondary BEC 2002 and K-12 Curriculum

Learning Areas		2002 BEC (hours per week)	K to 12 Education (hours per week)
English		5	4
Filipino		4	4
Mathematics		5	4
Science		6	4
Araling Panlipunan	MAKABAYAN	4	3
Edukasyon sa Pagpapakatao		2-3	2
Music, Arts, Physical Education, and Health (MAPEH)		4	4
Technology and Livelihood Education		4	4

Note: From "K-12 Toolkit" by SEAMEO INNOTECH, 2012, p. 33. Philippine Copyright 2012.

The additional two-year curriculum is the integration of general education courses from college to senior high school curriculum (CHED, 2013); but according to DepEd (2015) although they sound like college courses, the subjects are designed to prepare the students to become college-ready. Decongesting the curriculum could be deletion of some competencies as what the DepEd did in the issuance of Most Essential Learning Competencies (MELC) in 2020. Merging of related competencies within or outside a certain content area to form a common theme without compromising the learning outcomes could also be one of the solution.

Strengthening Continuity to Achieve Progression

Result of this study implies that continuity is essential to achieve progression. Teachers perceiving a slow progression in the curriculum indicates weak continuity in the mathematics curriculum. The fragmented nature of the mathematics curriculum directly affects instruction and learning. The participants thought that devising bridging activities across JHS grade levels could improve the continuity of teaching and learning. According to Galton et al., (2003), bridging projects support curriculum continuity. In view of primary-secondary transition in his study, students are given set of materials in primary school to be continued when they transfer to secondary school. He observed the need to have increasing support continuity of pedagogy and curriculum as both primary and secondary teachers jointly plan for the materials. The teachers have not yet come to this kind of bridging intervention but have shown interest in its value and application.

The continuity and progression of competencies is articulated vertically, yet teachers' consultation remains horizontal or same grade level. Liaisons are deemed desirable to improve continuity and progression in the curriculum (Chapman, 2002). However, at the end of the school year, teachers do not mention to the next teacher the uncovered competencies. The next math teacher would assume that the competencies were all covered. Although they have meetings and seminars with teachers from other grade levels, there is no vertical transfer of information and pedagogy.

Teacher 2: *There is no transfer from teachers coming from other grade levels; Yes, it should have been like that because we really don't consult them. What do they say? We don't talk about it.*

Teacher 6: *We cannot actually describe progression if as a teacher we will not talk every end of the school year without knowing the last topic that the teacher took. How can we describe progression we do not know the last topic that this particular teacher taught?*

Emphasis on the Horizontal Articulation of Mathematics Content

Most of the mathematics teachers regarded that the math curriculum guide is composed of fragmented content areas of Algebra, Geometry, and Statistics among others. Every time they shift from one content area to another, they perceive a discontinuity. It is because for most of them, it seems like they are starting with a completely different sets of competencies. There were a few who explicitly pointed out the horizontal connections among the different content areas of the subject.

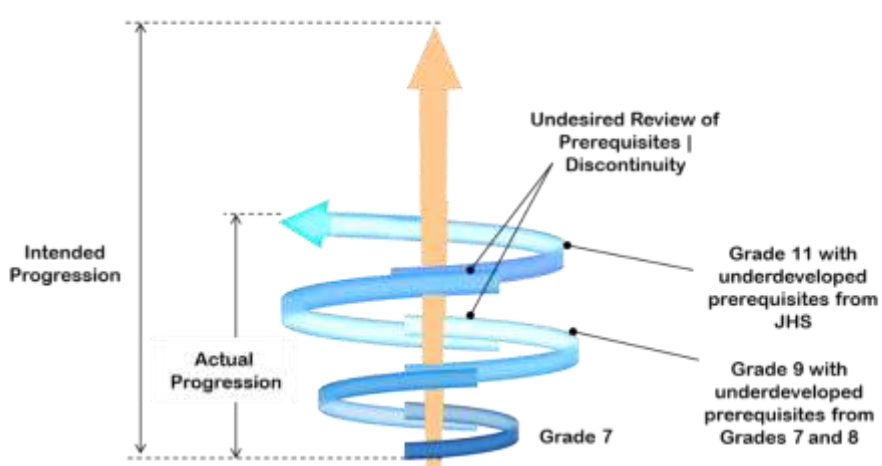
The National Council of Teachers of Mathematics (NCTM) stated that mathematics is "a web of closely connected ideas" which are linked by particular relationships and connections. Mathematical connections are a feature of the subject itself and the pedagogical task of the teacher becomes that of making sure the connections get into the mind of the learner (Businskas, 2008). If the content areas and competencies are treated as disjoint and fragmented, most likely it will influence one's pedagogy. With this, there is a need to emphasize not just the vertical articulation of the curriculum but the horizontal integration as well among the different content areas of mathematics, presenting them as one body of knowledge to students.

Revisiting Spiral Progression Approach in Mathematics vis-à-vis Teaching and Learning Outcomes

Result of this study shows that teachers perceived vertical continuity and progression features of JHS mathematics curriculum. However, this has brought some concerns in the teaching and learning process. The findings show that teachers perceived discontinuity of instruction in mathematics and slow progression in the students' learning. Math teachers experienced frustration on the unending review of prerequisites because sometimes they have to start from the basic. Students have underdeveloped prerequisites due to poor retention, non-mastery of concepts or uncovered competencies. With this, teachers tend to revert, making the curriculum discontinuous impeding the progression of topics. As a result, the actual progression fall short against the intended curriculum progression as illustrated in Figure 13. Teaching "a little of everything" in the spiral progression approach has led to widening but not deepening of understanding of the subject matter.

Figure 13

Discontinuity and Slow Progression in the Mathematics Curriculum



The spiralling was seen by math teachers as problematic leading to shallow, discontinued and slow learning progression. This study reveals perceived discontinuity in teaching JHS mathematics with implication on the slow progression of students' learning. Students' slow learning progression in Math under the spiral curriculum was also confirmed in the studies of Capangpangan (2015), Braza and Supapo (2014), and Resurreccion and Adanza (2015). Orale and Uy (2018) have theorized the presence of Broken Spiral in the mathematics curriculum where students with underdeveloped prerequisites will be dealing with more complex tasks. More so, the United States implementing spiral mathematics has been criticized for using the spiral approach tagged as "inch deep and mile wide" mathematics instruction because students are left with little knowledge to cover more topics (Duffrin, 2005).

Nonetheless, the effectiveness of spiral progression approach is different for diverse types of learners. Result of this study shows that it has contrasting impact and effect to fast and slow learners. In the implementation of K-12 curriculum, it was noted that most of Philippine delegates in international mathematical competitions such as International Mathematical Olympiad (IMO) earned two-fold gold medallist in 2016; and this success was attributed to the spiral curriculum. But in international large scale assessments like the TIMSS and PISA, the country yielded poor scores ranked as second lowest in Science and Mathematics among 79 countries in 2018 (PISA, 2018). This inconsistency implies that the highly intellectual students were boosted by the spiralling of the curriculum; but the majority of the students were not. It seems that the disadvantages in using spiral approach supersede the expected benefits. Math is already progressive in nature. Spiralling the topics only adds complexity in learning the subject.

It is then imperative to revisit the spiral progression approach in teaching mathematics apropos to the evidences on the teaching and learning outcomes using the spiral progression in teaching Math.

Chapter 4

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter presents the summary of this research, together with the synopsis of its results. Though the scope of the indicated conclusion is limited within the context of research locale, still the context is relevant to understanding how teachers understood and viewed continuity and progression in teaching the Mathematics curriculum. Recommendations for further study conclude this chapter.

4.1 Summary of the Study

A comprehensive educational reform known as K-12 Basic Education Program is implemented using the spiral curriculum with the following principles: (a) revisiting topics throughout the school career, (b) building upon previously learned knowledge relating to the new knowledge, and (c) moving from simple to complex task. In the design of the spiral curriculum using the spiral progression approach, curriculum designers have to create continuous and progressive curriculum (Drew, 2020). The first two principles characterize continuity while the third principle describes progression in the curriculum. The spiral progression approach allows the learners to get familiar of the basic subject contents in their early years while widening and deepening their understanding as they get promoted to higher levels. In mathematics, Algebra, Geometry and Probability and Statistics are given in Junior High School with increasing complexity. However, review of students' mathematics performance from secondary schools in the Philippines reveals that students have not attained mastery of contents and skills against the expected performance standards. The learners get promoted despite having underdeveloped prerequisite skills. This is contrary to what spiral curriculum model projects.

Examining how continuity and progression in teaching mathematics is observed, together with the principles of the spiral curriculum, is needed to understand the conflicting results. Hence, this study explored how mathematics teachers made use of the learner's previous knowledge to facilitate the current learning observing continuity and progression in teaching mathematics in terms of the principles of the spiral curriculum. This was comprehended better through the teachers' understanding of continuity and spiral progression approach and how the teachers design, implement and assess learning.

The objectives were addressed using qualitative design specifically case study design. Data were obtained through classroom observations, individual interviews, focus group discussions (FGD) and documentary analyses. The interview guides for individual interview and focus group discussion were validated by three experts using the Survey/Interview Validation Rubric for Expert Panel - VREP© by Marilyn K. Simon. The instruments got a general rating of 3 which means that they can be used. The data were transcribed and analyzed into themes using thematic analysis verified by NVivo 12 Pro, a qualitative data analysis software. All 10 JHS mathematics teachers in a secondary public school were involved with the participation of the head of the department. Data gathering was conducted from July to August of school year 2019-2020. The results were able to generate inputs and implications to curricular design and existing policies.

4.2 Summary of Results

The following are significant findings based on each research question.

Teachers' Understanding and View of Continuity and Spiral Progression

The vertical articulation of topics using the spiral curriculum was clear to mathematics teachers. They described continuity as the presence of common skills, topics or competencies from one grade level to another, and it is the utilization of previous concepts for succeeding lessons. Progression in the curriculum was described as the arrangement of topics and competencies with increasing difficulty. The participants described that teaching in spiral progression approach is giving "a little of everything" to students. The following themes emerged as teachers' views on continuity and spiral progression in teaching JHS mathematics.

Discontinuity of Instruction and Student' Learning. Although the participants perceive that the curriculum reflected in the curriculum guide is designed in a continuous and progressive manner, there are some concerns when it comes to students' learning. Dividing the topics and/or sub-topic and distributing the content areas throughout JHS level were seen as strong ground for discontinuity in instruction and students' learning. Some teachers perceived weak connections of math competencies within and across grade levels while others have difficulty relating and bridging math competencies.

Slow Progression in Learning. Due to the fragmented content and giving a little of everything to students, teachers perceived that it has affected the students' learning. For them, this has affected the continuity of knowledge from simple to complex, and students' knowledge in the areas of mathematics has become weak. Sometimes students are confused when moving from one content area to another. The competencies in JHS mathematics curriculum guide is perceived to be progressive; however, due to the problems mentioned, they observed that the process of learning becomes slow which affected the school's performance in Metrobank-MTAP DepEd Math Challenge where their JHS students got very low scores. It was found out that they were far behind against the expected competencies.

Poor Mastery of Mathematics Content. Almost all of the teacher-participants expressed consistent sentiment that K-12 students have no mastery of mathematics content due to poor knowledge retention, underdeveloped prerequisites or poorly or untaught topics. The non-mastery of content makes it difficult to advance to more complex task. Students' knowledge in the areas of mathematics is weak. Operations on signed numbers are the most cited non-mastered topic by the participants despite being revisited from Grades 7 to 10. Math teachers perceived that continuity of topics and mastery of subject matter among students is better in the disciplined-based approach than in spiral upon comparison.

Choosing between Quality Teaching and Quantity of Competencies. Teachers are torn between quality of teaching and quantity of competencies in the current mathematics curriculum. It turned out that when teachers consider quality in teaching such as reviewing the prerequisites and using student-centered approaches, they most likely will not finish the curriculum, thus compromising the continuity of topics. On the other hand, aiming to cover more competencies to finish the curriculum results to superficial learning affects the learning progression of students. The following are factors why teachers have difficulty keeping with the curriculum are due to congested competencies, class suspensions and interruptions and cycle of unfinished curriculum.

Contrasting Impact and Effect to Different Types of Learner. Because of the complex nature of spiral curriculum, teachers believe that the impact and effect to students vary. They believe that spiral curriculum is advantageous to fast learners but a menace to slow learners. The impact of spiral mathematics is good for fast learners because they can easily recall past lessons and a little guidance from them make the students apply easily previous concepts to complex tasks, especially those who are inclined in the subject. Moreover, the spiral mathematics complements the maturity of the cognitive aspect of fast learners. As a result they tend to advance more in the subject. Meanwhile, slow learners have poor retention span and are left behind. Dealing with more complex task despite their underdeveloped prerequisite makes their situation pitiful.

Design, implementation and assessment in terms of (a) revisiting topics, (b) building upon previously learned knowledge relating to the new knowledge, (c) moving from simple to complex task.

The study explored the lesson design, implementation and student assessment to determine the continuity and progression of the current mathematics curriculum through the key principles of spiral approach discussed below.

Designing the Lesson

Revisiting Topics. Teachers identify the prerequisites needed for the lesson. The recapitulation is usually in the "Opener" of 4As and "Engage" of 6Es instructional model.

Aside from reviewing before the lesson proper, it is embedded in course of discussion. Teachers are mandated to follow the guide and as much as possible not deviate from it. They called it as the "heart of making a plan" and their "bible" in teaching.

Building upon Previously Learned Knowledge Relating to the New Knowledge. Participants guide the students to relate the previous knowledge to the new objective through preliminary activities, drills, brainstorming and assignments as reflected in their lesson plans.

Moving from Simple to Complex Task. Teachers structured their plan to prepare the students for more complex and complicated tasks. The documents presented by the participants showed that there is a movement from simple to complex competencies and skills.

Implementing the Lesson

Revisiting Topics. *R*evisiting topics is not a problem when the topic is simple and students have good memory retention; but when a large number of class population have poorly mastered or forgotten the prerequisites, this posed immense problem for teachers and to the current lesson itself.

Building upon Previously Learned Knowledge Relating to the New Knowledge. Scaffolding such as structuring questions prompting students to review and utilize students' prior knowledge was observed from the teachers. The perceived factors affecting successful building of previous knowledge are the complexity of topic and students' prior knowledge. Complex topics requires more prerequisites. When students have poor mastery of content or prerequisites were poorly taught to students in early years, it will be difficult for students to build from their prior knowledge.

Moving from Simple to Complex Task. Teachers observe that as the topics are getting more complex, students' performance is getting low. Teachers perceive that there is progression if the mathematics curriculum guide will be the only basis; but in the implementation and students' learning, there is no progression.

Assessing Students' Learning

Revisiting Topics. It is important to carefully plan the assessment in order to capture the objectives. Students need to be prompted to elicit prior knowledge.

Building upon Previously Learned Knowledge Relating to the New Knowledge. Even in the assessment, teachers design their assessment tool in a manner of scaffolding. It is noticeable, however, that participants gave very few formative assessment items, which in some class observations were either rushed or not finished.

Moving from Simple to Complex Task. Observing Bloom's Taxonomy gives a clear movement from simple to complex cognitive tasks. However, participants could not give complex activities to students for the fear that they might not finish the lessons on time. Adding probing activities to extend students' learning is sometimes not possible due to limited time and students' ability.

Inputs and Implications to Curricular Design

The following are suggested inputs to curricular design based on the point of view of mathematics teachers:

Decongesting the Curriculum. The K-12 mathematics curriculum is viewed as congested. Participants has unanimous suggestion to lessen the competencies. They find that the activities in the learning modules are repetitive. A closer comparison of 2002 BEC and K-12 curriculum reveals not a decongestion, but a reduction of instructional hours. This contradicts that the additional two more years in the basic education was considered one solution to decongest the curriculum.

Emphasis on the Horizontal Articulation of Mathematics Content. Most of the mathematics teachers regarded that the math curriculum guide is composed of fragmented content areas of Algebra, Geometry, and Statistics among others. Every time they shift from one content area to another, they perceive a discontinuity. There were a few who explicitly pointed out the horizontal connections among the different content areas of the subject. The NCTM stated that mathematics is "a web of closely connected ideas" which are linked by particular relationships and connections. If the content areas and competencies are treated as disjoint and fragmented, most likely it will influence one's pedagogy. With this, there is a need to emphasize not just the vertical articulation of the curriculum but the horizontal integration as well among the different content areas of mathematics, presenting them as one body of knowledge to students.

Strengthening Continuity to Achieve Progression. Result of this study implies that continuity is essential to achieve progression. The perceived fragmented nature of the mathematics curriculum directly affects instruction and learning. The participants suggested inter-grade liaisons among teachers to discuss bridging pedagogies and activities.

Revisiting Spiral Progression Approach in Mathematics vis-à-vis Teaching and Learning Outcomes. This study suggests review of spiral progression approach in teaching mathematics considering the growing studies on the disadvantages and challenges in the teaching and learning outcomes. Result of this study shows that teachers perceived discontinuity of mathematics content and discussion with slow progression in the learning process. The actual progression falls short against the intended curriculum progression. Teaching "a little of everything" in the spiral progression approach has led to widening but not deepening of understanding of the subject matter. Teachers' perceive that spiral progression approach is not "one-size-fits-all" approach to different types of learners. Several studies have confirmed non-mastery of mathematics content among K-12 students despite the claim that spiraling mathematics would lead to better mastery.

4.3 Limitations

The study focuses only on teachers' perception of continuity and progression in teaching the mathematics curriculum considering the principles of the spiral curriculum: (a) revisiting topics throughout the school career, (b) building upon previously learned knowledge relating to the new knowledge, and (c) moving from simple to complex task. Themes, inputs and implications were generated based form the participants' responses and implementation. The scope of the indicated conclusion is limited within the context of research locale and participants.

4.4 Conclusion

The main objective of the study is to explore how mathematics teachers make use of the learner's previous knowledge to facilitate the current learning in order to attain continuity and progression in teaching junior high school. This was answered by determining teachers' understanding and view of continuity and spiral progression and how the lessons were designed, implemented, and assessed in terms of the key features of spiral progression approach to ensure curriculum continuity and progression in teaching mathematics.

Result of this study revealed that the participants have a clear understanding of continuity and progression. Mathematics teachers made use of scaffolding strategies and guided activities to help students utilize prior knowledge for the new lesson. However, they have difficulty meeting the demands and standards in implementing the spiral progression in teaching mathematics. Specifically, Bruner's 2^{nd} and 3^{rd} key principles such as knowledge build-up from students' prior knowledge and moving from simple to complex task were challenging for teachers to implement. This is due to the following perceived factors: students' prior knowledge, type of student, congested curriculum, and geographical disadvantage causing class suspensions and unfinished curriculum at the end of school year. These factors were perceived by the teachers to have learning implications such as discontinuity of learning and slow learning progression in mathematics. These are characteristics of a Broken Spiral introduced by Orale and Uy (2018), and teachers observe this existence in the present curriculum for JHS mathematics.

On the other hand, the K-12 spiral curriculum is both horizontally and vertically articulated, but much attention is given to the latter. A few teachers have difficulty relating and bridging competencies from different Math content areas within and across grade levels. They treat the different content areas of Math as a separate and fragmented components thereby perceiving a discontinuity. Furthermore, findings of this study support that continuity is essential to achieve progression.

In general, the participants have negative perceptions of spiral progression approach in teaching Math. With teachers' experience of teaching mathematics using the disciplined-based and spiral approach, they perceive that spiral approach brought negative impact to teaching and learning mathematics. They find the former more effective in targeting mastery of competencies, and continuity and progression in teaching and learning Math is perceived to be better addressed.

The results of this study is based on the perception of ten mathematics teachers together with the documented classroom practices from one public school in Albay, Philippines. Hence, the scope of the indicated conclusion is limited within the context of research locale and participants.

4.5 Recommendations

On the basis of the results, this study recommends the following for future research direction:

1. Conduct a regular intergrade consultations to discuss possible exclusion, inclusion or innovations with the current mathematics curriculum, competencies or topics including bridging strategies. These bridging strategies may include what and how teachers will do in their teaching that will assure improvement and progression of previous topics and skills. This will be attended by stakeholders but not limited to teachers, content experts, supervisors and curriculum developers.
2. Based on the results of this study, math teachers have difficulties keeping up with the mathematics curriculum because of too many competencies. With this, teachers need to be trained with research and didactical skills. In this way they will able to try some innovations focusing say, on sequencing the competencies and skills, without comprising the intended learning outcomes expected from the students. This may be done by merging competencies that teachers think are repetitive which could solve curriculum congestion and enhance continuity and learning progression. Possible action researches may also be done that may help them to be able to identify factors that prevented them to reach the expected competencies.
3. Teachers may design instructional scaffolding strategies in teaching Mathematics specifically on how to build new knowledge from prior knowledge.

4. Further research studies are recommended to add to the meager literatures in the implementation of the K-12 Mathematics Curriculum spiral progression as practiced in the Philippines or in comparison with other countries as well.

REFERENCES

Acharya, B. (2017). *Factors affecting difficulties in learning mathematics by mathematics learners.* International Journal of Elementary Education. http://doi.org/10.11648/j.ijeedu.20170602.11

Adey, F. (2006). *Dimensions of progression in a curriculum*. The Curriculum Journal. http://doi.org/10.1080/0958517970080304

Alexander, R. (2000). *Culture and pedagogy: International comparisons in primary education.* Blackwell Publishers Ltd.

Ambrose, S., Bridges, M., Lovett, M., DiPietro, M. & Norman, M. (2010). *How learning works: Seven research-based principles for smart teaching.* Jossey-Bass.

Attard, C. (2010). *Students' experiences of mathematics during the transition from primary to secondary school*. The Mathematics Education Research Group of Australia.

Beets, P. & Le Grange, L. (2005). *Continuity and progression: The achilles' heel of the national curriculum statement for geography?* South African Journal of Education.

Bennetts, T. (2002). *Continuity and* progression. In: Smith M (ed.). Teaching Geography in Secondary Schools: A reader. Routledge/Falmer.

Benyon, L. (2007). *Curriculum continuity*. International Journal of Primary, Elementary and Early Years Education. http://doi.org/10.1080/03004278185200201

Bowen, G. (2009). *Document analysis as a qualitative research method*. Qualitative Research Journal. http://doi.org/10.3316/QRJ0902027

Braund, M. & Driver, M. (2005). *Pupils' perceptions of practical science in primary and secondary school: Implications for improving progression and continuity of learning*. Educational Research. http://doi.org/10.1080/0013188042000337578

Braza, M. & Supapo, S. (2014). *Effective solutions in the implementation of the K to 12 Mathematics Curriculum*. SAINSAB ISSN 1511-5267.

Bruner, J. S. (1960: revised edition 1977). *The process of education*. Harvard University Press.

Businskas, A.M. (2008). *Conversations about connections: How secondary mathematics teachers conceptualize and contend with mathematical connections.* Simon Fraser University.

Butt, G. (2002). *Reflective Teaching of Geography.* Continuum.

Cabansag, M. (2014). *Impact statements on the k-12 science program in the enhanced basic education curriculum in provincial schools*. Journal of Arts, Science and Commerce.

Capangpangan, D. (2015). *Issues on the implementation of the k+12 curriculum*.

Capate R. N. & Lapinid, M. R. (2015). *Assessing the mathematics performance of grade 8 students as basis for enhancing instruction and alignment with K to 12 curriculum.* Proceedings of the DLSU Research Conference 2015.

Casayuran, M. (2020, February 1). *Gatchalian: Curriculum reform needed for better PISA result.* Manila Bulletin. http://news.mb.com.ph/2020/02/10

Chapman, S. (2002). *Continuity and progression within and between key stages 2 and 3 in geography*. A Dissertation presented to the University of Birmingham.

Clabaugh, G. (2010). *The educational theory of Jerome Bruner: a multidimensional analysis.* New Foundations.

Coad, J. & Jones, K. (1999). *Curriculum continuity in mathematics: a case study of the transition from primary to secondary school.* University of Southampton Centre for Research in Mathematics Education Working Paper.

Coelho, C. S. & Moles, D. R. (2015). *Students' perceptions of a spiral curriculum.* European Journal of Dental Education. http://doi.org/10.111/eje.12156

Commission on Higher Education. (2013). *General education curriculum: Holistic understandings, intellectual and civic competencies*. CHED Memorandum Order No. 20 s. 2013. http://www.ched.gov.ph/wp-content/uploads/2013/07/CMO-No.20s2013.pdf

Corpuz, B. (2012). *The spiral progression approach in the k-12 curriculum.* Congressional Commission on Education (EDCOM).

Cowles, E. (2018). *Teaching: complex, challenging, inspiring, endlessly interesting, and always vital.* The American Biology Teacher. http://doi.org/10.1525/abt.2018.80.6.407

Creswell, J. (2014). *Research design: Quantitative, qualitative and mixed methods approaches* (4th ed.). SAGE Publications Inc.

Department of Education. (2015). *An introductory guide to senior high school.* Academia. http://www.academia.edu/37971012/AN_INTRODUCTORY_GUIDE_to_SENIOR_HIGH_SCHOOL

Dimaculangan, K. (2016). *Mathematical proficiency in algebra of grade 10 students and the implementation of spiral curriculum*. A thesis presented to the Philippine Normal University.

Diwa, GS. (2018). *Math goes spiral*. DepEd Bataan.

Dowding, T. J. (1993). *The application of a spiral curriculum model to technical training Curricula*. Educational Technology.

Durlak, J. A., & Wells, A. M. (1997). *Primary prevention mental health programs for children and adolescents: A meta-analytic review.* American *Journal of Community Psychology*.

Duze, C. O. (2012). *The changing role of school leadership and teacher capacity building in teaching and learning.* Journal of Emerging Trends in Educational Research and Policy Studies.

Bell, M. (2007). *The spiral: Why everyday mathematics distributes learning*. University of Chicago. McGraw-Hill Education. http://everydaymath.uchicago.edu/about/why-it-works/spiral/

Education Partnership Inc. (2012). *The spiral curriculum*. https://www.google.com/url?sa=t&source=web&rct=j&url=https://files.eric.ed.gov/fulltext/ED538282.pdf&ved=2ahUKEwiP-b38hd3oAhWMHXAKHfIBCKMQFjABegQIDRAG&usg=AOvVaw3go8MCn8t2bzSdXiCnzZPC

Fereday, J. & Muir-Cochrane, E. (2006). *Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development.* International Journal of Qualitative Methods. http://doi.org/10.1177/160940690600500107

Ferido, M. (2013). *The spiral progression approach in science*. UP NISMED.

Galton, M., Gray, J., & Ruddock, J. (2003). *Transfer and transitions in the middle years of schooling (7–14): Continuities and discontinuities in learning* .Queen's Printer.

Gamoran, A. (2001). *Beyond curriculum wars: Content and understanding in mathematics.* In T. Loveless, Ed. The Great Curriculum Debate. Brookings Institution Press.

General Teaching Council for England. (2006). *Jerome Bruner's constructivist model and the spiral curriculum for teaching and learning*. SCRIBD. http://scribd.com/doc/248043308/06RE031-Jerome-Bruner-s-Constructivist-Model-and-the-Spiral-Curriculum-for-Teaching-and-Learning

Harden, R. M., & Stamper, N. (1999). *What is a spiral curriculum?* Medical Teacher.

Hatuina, M.R. (2013). *The spiral curriculum*. Slide Share. http://www.slideshare.net/mobile/lavirchameiram/the-spiral-curriculum

Hoyo, M. & Allen, D. (2006). *The use of triangulation methods in qualitative educational research*. Journal of College Science Teaching.

Incebacak, B., Akaydin, B., & Ersoy, E. (2016). *Teacher's views on spiral approach in mathematics curriculum.* Proceedings of European Conference on Social and Behavioral Sciences.

K to 12 Mathematics Curriculum Guide. (2016). Department of Education.

Kimwarey, M.C., Chirure, H.N. & Omondi, M. (2014). *Teacher empowerment in education practice: Strategies, Constraints and Suggestions.* IOSR Journal of Research & Method in Education, 4(2), pp.51-56.

Marks, H. & Louis, K.S. (1997). *Does teacher empowerment affect the classroom? The implications of teacher empowerment for instructional practice and student academic performance.* Educational Evaluation and Policy Analysis, 19(3), pp. 245-275.

MATHTED & SEI-DOST. (2011). *Framework for Philippine mathematics teacher education*. SEI-DOST & MATHTED.

MATHTED & SEI-DOST. (2011). *Mathematics framework for Philippine basic education*. SEI-DOST & MATHTED.

Matingwina, T. (2016). *Information literacy curriculum design*. Slide Player. http://slideplayer.com/slide/13357702/

Mitchell, P. F. (2011). *Evidence-based practice in real-world services for young people with complex needs: New opportunities suggested by recent implementation science. Children and Youth Services Review*.

Nicolescu, B. & Petrescu, T. (2014). *On the continuity mathematics curriculum between primary and secondary school*. Social and Behavioral Sciences.

Orale, R. & Uy. M. E. (2018). *When the spiral is broken: Problem analysis in the implementation of spiral progression approach in teaching mathematics.* Journal of Academic Research.

Orbe, J., Espinosa, A. & Datukan, J. (2018). *Teaching chemistry in a spiral progression approach: lessons from science teachers in the Philippines.* Australian Journal of Teacher Education.

Owen, D. & Ryan, A. (2001). *Teaching Geography 3–11: The essential guide*. Continuum.

Pinilla, M.F. (2007*). Fractions: Conceptual and didactic aspects*. Acta Didactica Comenianae Mathematics.

PISA 2018. (2019). National report of the Philippines.

Polit, D.F., & Beck, C.T. (2012). *Nursing research: Generating and assessing evidence for nursing practice.* Lippincott Williams and Wilkins.

Read, L. (2017). *Investigations into using data to improve learning. Philippines case study*. Global Economy and Development at Brookings.

Republic Act No. 10533. (2013). *An act enhancing the Philippine basic education system by strengthening its curriculum and increasing the number of years for basic education, appropriating funds therefor and for other purposes.* Official Gaette of the Republic of the Philippines. http://www.officialgazette.gov.ph/2013/05/15/republic-act-no-10533/

Resurreccion, J. A. & Adanza, J. (2015). *Spiral progression approach in teaching science in selected private and public schools in Cavite.* Proceedings of the DLSU Research Congress 2015.

Samala, H. (2018). *Spiral progression approach in teaching science: A case study.* 4th International Research Conference on Higher Education, KnE Social Sciences. http://doi.org/10.18502/kss.v3i6.2404

Seameo K to 12 Toolkit (2012)*:* Reference Guide for Teacher Educators, School Administrators and Teachers.

Sergio, M. R. (2011). *K-12 education reform: problems and prospects*.

Stake, R. E. (1995). *The art of case study research.* Thousand Oaks. SAGE.

Steed, E. & Sudworth, P. (1985). *The humpback bridge*, in: R. Derricott (ed.) *Curriculum continuity.*

SUNY Empire State College. (2020). *Breadth and depth of learning*. http://www.esc.edu/degree-planning-academic-review/evaluator-resources/assessing-learning/breadth-and-depth/

Taba, H. (1962). *Curriculum development*. Harcourt, Brace and World.

The Glossary of Education Reform. (2013). *Learning Gap.* http://edglossary.org/learning-gap/

Ulep, S. (2013) *Spiral Progression in the K-12 mathematics curriculum.* University of the Philippines, National Institute of Science and Mathematics Education

Development (UP NISMED).
http://www.academia.edu/36107966/SPIRAL_PROGRESSION_in_the_K_12_MATHEMATICS_CURRICULUM

Wood, E. & Bennett, N. (2001). *Early childhood teachers' theories of progression and continuity*. International Journal of Early Years Education.

Yin, R. K. (1994). *Case study research: Design and methods* (2nd ed.). Thousand Oaks. SAGE.

APPENDICES

A Request of Endorsement from the School Division

Philippine Normal University
The National Center for Teacher Education
College of Graduate Studies and Teacher Education Resear

DepEd, TABACO CITY DIVISION
RECEIVED
DATE: 23 MAY 2019
TIME: 8:09AM
CONTROL No.: 0000001341
BY:
RECORDS SECTION

May 22, 2019

[redacted]

Dear Sir:

Greetings!

I am Judy V. Bongala, a student of Philippine Normal University pursuing Master of Arts in Mathematics Education with specialization in Secondary School Teaching. I will be conducting my thesis study entitled "Curriculum Continuity and Progression in Teaching Junior High School Mathematics."

With this, I would like to ask permission to conduct my study at Tabaco City Division specifically in San Lorenzo National High School. The study involves document collection, classroom observation and interview to Junior High School Math teachers. The data gathered will be used for the purpose of the research and will be treated with strict confidentiality. The data gathering is hoped to be done this July 2019.

I am willing to share the result to your office upon request.

I am hoping for your favourable response. Thank you very much!

Very truly yours,

JUDY V. BONGALA

Noted:

ROSIE L. CONDE, PH.D.
Adviser

B Request for Permission to Conduct Research to the School

Philippine Normal University
The National Center for Teacher Education
College of Graduate Studies and Teacher Education Research

May 27, 2019

SAN LORENZO NATIONAL HIGH SCHOOL
RECEIVED
BY:
DATE: 5/29/19
TIME: 3:30 p.m.

Dear Sir:

Greetings!

I am Judy V. Bongala, a student of Philippine Normal University pursuing Master of Arts in Mathematics Education with specialization in Secondary School Teaching. I will be conducting my thesis study entitled "Curriculum Continuity and Progression in Teaching Junior High School Mathematics."

With this, I would like to ask permission to conduct document collection, classroom observation and interview to Junior High School Math teachers in your school. The data gathered will be used for the purpose of the research and will be treated with strict confidentiality. I am willing to share the result to your office upon request. The data gathering is hoped to be done this July 2019.

Herewith is the endorsement from the Office of the Schools Division Superintendent.

I am hoping for your favorable response. Thank you very much!

Very truly yours,

JUDY V. BONGALA

Noted:

ROSIE L. CONDE, PH.D.
Adviser

C Informed Consent Form to the Participants

Philippine Normal University
The National Center for Teacher Education
College of Graduate Studies and Teacher Education Research

____

____
____
____

Dear Sir/Madam:

Greetings!

I am Judy V. Bongala, a student of Philippine Normal University pursuing Master of Arts in Mathematics Education with specialization in Secondary School Teaching. I will be conducting my thesis study entitled "Curriculum Continuity and Progression in Teaching Junior High School Mathematics."

With this, I would like to invite you to be one of the participants. It involves document collection (sample lesson plan, students' work and assessment), classroom observation and interviews (individual and focus group discussion, good for 20 and 90 minutes respectively). It is hoped to be done this July 2019.

The data gathered will be used for the purpose of the research and will be treated with strict confidentiality. Your participation is completely voluntary; hence you have the right to withdraw anytime. There will be no monetary collection nor make you responsible for the reproduction cost of any documents.

I am willing to share the result of the study to your school. If you have any questions, you may reach me at bongala.jv@pnu.edu.ph or 09269633405.

Thank you very much!

Very truly yours,

JUDY V. BONGALA

Noted:

ROSIE L. CONDE, PH.D.
Adviser

Writing your name below confirms your valuable participation.

Name: _______________________ Contact Number: _______________

School: _______________________ E-mail: _______________

D Endorsement Letter from the School Division

Republic of the Philippines
Department of Education
Region V (Bicol)
SCHOOLS DIVISION OFFICE
Tabaco City

1st Endorsement
May 28, 2019

Respectfully returned to Ms. Judy V. Bongala, MAIME student/researcher from Philippine Normal University, interposing no objection to her request to conduct document collection and interview to Junior High School Math teachers in relation to her study entitled " ***Curriculum Continuity and Progression in Teaching Junior High School Mathematics*** " in partial fulfillment of the requirements for the degree of Master of Arts in Mathematics Education. Provided, however, that the provision on DepEd Order No. 9, s. 2005 entitled *Instituting Measures to Increase Engages Time-on-Task and Ensuring Compliance Therewith* be strictly complied with.

Provided further, that the data gathered shall be used only for the purpose of the research and shall be treated with strict confidentiality.

7:30p.m.

[redacted]
Assistant Schools Division Superintendent
Officer-In-Charge
Office of the Schools Division Superintendent

E Guide Questions for Individual Interview and Focus Group Discussion

Unstructured Interview

1. What is your understanding of continuity and progression in the curriculum?
2. What is your view of spiral progression in teaching mathematics?\
3. Are there ways that your school or department implement to monitor continuity and progression in mathematics? Please give examples/details.

Focused Group Discussion

1. What are the things you consider in planning a lesson?
2. How do you present new lessons to students?
3. How do you assess students' learning?
4. What specific practices do you employ to help students use their previous knowledge to learn the current one?
5. To what extent do you feel that continuity and progression successfully occurs in junior high school? Why?
6. What are the things that hinder continuity and progression in teaching junior high school (JHS) mathematics?
7. What are your suggestions to improve continuity and progression in teaching JHS mathematics?

F Survey/Interview Validation Rubric for Expert Panel - VREP© By Marilyn K. Simon with input from Jacquelyn White

Score
1=Not Acceptable (major modifications needed)
2=Below Expectations (some modifications needed)
3=Meets Expectations (no modifications needed but could be improved with minor changes)
4=Exceeds Expectations

Criteria	Operational Definitions	1	2	3	4	Questions NOT meeting standard (List page <u>and</u> question number) and need to be revised. *Please use the comments and suggestions section to recommend revisions.*
Clarity	• The questions are direct and specific. • Only one question is asked at a time. • The participants can understand what is being asked. • There are no *double-barreled* questions (two questions in one).					
Wordiness	• Questions are concise. • There are no unnecessary words					
Negative Wording	• Questions are asked using the affirmative (e.g., Instead of asking, “Which methods are not used?”, the researcher asks, “Which methods *are* used?”)					
Overlapping Responses	• No response covers more than one choice. • All possibilities are considered. • There are no ambiguous questions.					
Balance	• The questions are unbiased and do not lead the participants to a response. The questions are asked using a neutral tone.					
Use of Jargon	• The terms used are understandable by the target population.					

	• There are no clichés or hyperbole in the wording of the questions.					
Appropriateness of Responses Listed	• The choices listed allow participants to respond appropriately. • The responses apply to all situations or offer a way for those to respond with unique situations.					
Use of Technical Language	• The use of technical language is minimal and appropriate. • All acronyms are defined.					
Application to Praxis	• The questions asked relate to the daily practices or expertise of the potential participants.					
Relationship to Problem	• The questions are sufficient to resolve the problem in the study • The questions are sufficient to answer the research questions. • The questions are sufficient to obtain the purpose of the study.					

Comments and Suggestions

G Permission to Use an Existing Validation Rubric for Expert Panel (Vrep ©)

December 5, 2018

To: Judy V. Bongala,

Thank you for your request for permission to use VREP in your research study. I am willing to allow you to reproduce the instrument as outlined in your letter at no charge with the following understanding:

- You will use this survey only for your research study and will not sell or use it with any compensated management/curriculum development activities.
- You will include the copyright statement on all copies of the instrument.
- You will send your research study and one copy of reports, articles, and the like that make use of this survey data promptly to our attention.

If these are acceptable terms and conditions, please indicate so by signing one copy of this letter and returning it to me.

Best wishes with your study.

Sincerely,

Marilyn K. Simon, Ph.D

Marilyn K. Simon, Ph.D.

____

Signature

More information can be found in Simon and Goes's Dissertation and Scholarly Research: Recipes for Success, 2018 edition.

http://www.dissertationrecipes.com/

I understand these conditions and agree to abide by these terms and conditions.

Signed ______________________________ **Date** December 7, 2018

Expected date of completion: September 2019

H Result of Instrument Validation

Original Questions	Comments			
	Validator 1	Validator 2	Validator 3	Resolution
1. What is your understanding of continuity and progression in the curriculum?	How would you describe continuity and progression in the curriculum?			• How would you describe continuity in the curriculum? • How would you describe progression in the curriculum?
2. What is your view of spiral progression in teaching math?	How would you describe the spiral progression in Math?			• How would you describe the spiral progression in Math?
3. Are there ways that your school or department implement to monitor continuity and progression in math? Please give examples/details.	What monitoring process in terms of continuity and progression do your school practice? Please give details.	What does your school or department do to implement continuity and progression in math? How do you monitor the continuity and progression in math?		• What monitoring process do your school/department practice to implement continuity and progression? Please give details. • How do you monitor the continuity and progression of the math curriculum in your class?

Validators' Ratings on the Instrument

	Validator 1	Validator 2	Validator 3	Mean Score
Clarity	3	3	3	**3**
Wordiness	3	3	3	**3**
Negative Wording	4	4	3	**4**
Overlapping Responses	4	2	3	**3**
Balance	3	3	3	**3**
Use of Jargon	4	3	3	**3**
Appropriateness of Responses Listed	4	2	3	**3**
Use of Technical Language	4	3	3	**3**
Application to Praxis	3	4	3	**3**
Relationship to Problem	4	3	3	**3**
	4	**3**	**3**	**3**

The mean score is 3 which means the instrument met the validators' expectations. Hence, no modifications needed but could be improved with minor changes.

I AUTHENTICITY CERTIFICATE

Philippine Normal University
The National Center for Teacher Education
PUBLICATION OFFICE
Taft Avenue, Manila 1000, Philippines

PUBLICATION OFFICE

AUTHENTICITY RESULT

Date of Release:	June 26, 2020
Result Code:	2020-0711
Submission ID:	1349450268
Title of Output:	Curriculum Continuity and Progression in Teaching Junior High School Mathematics
Author (s):	Judy V. Bongala

Authenticity Report:

Similarity Report: 7%

- *Interpretation*: A similarity of 7% means that 7% of the entire paper is similar to sources in Turnitin's (authenticity software) online repository. The colored bibliographical references denote the sources of similarity to previously published work which maybe from internet sources (6%), publications (1%), and student papers (5%) for the remaining similarity percentage.

- *Highlighted text in the Manuscript:*
    - Red marks and highlights are set of texts directly or exactly copied from online sources.
    - Other color marks and highlights are set of text exactly copied from other sources (student papers and publications).

Marie Paz E. Morales, Ph.D.
Director

PNU-MN-2016-PUB-QM-001
Revision No.: 01

Effective Date: August 10, 2017

J LANGUAGE EDITOR’S CERTIFICATE

Philippine Normal University
The National Center for Teacher Education
College of Graduate Studies and Teacher Education Research
Taft Avenue, Manila

15 June 2020

C E R T I F I C A T I O N

This certifies that I have edited the thesis titled “**Curriculum Continuity and Progression in Teaching Junior High School Mathematics”** by Judy V. Bongala, a candidate for the degree Master of Arts in Mathematics Education with Specialization in Secondary School Teaching.

MERRY RUTH MORAUDA GUTIERREZ, Ph.D. (Sgd)
CGSTER Faculty

K CERTIFICATE OF COMPLIANCE (REC FORM 20)

		Index No.	PNU-MN-2016-EPR-FM-020
PHILIPPINE NORMAL UNIVERSITY The National Center for Teacher Education Taft Ave. Cor. Ayala Blvd., Ermita, Manila 1000 Philippines Trunkline: +63-2-317-1768 loc 750/751 ▲ eprdc@pnu.edu.ph ▲ www.pnu.edu.ph		Issue No.	01
		Rev. No.	01
		Date:	09-24-2018
		Page	1 of 1
EPRDC	CERTIFICATE OF COMPLIANCE	QAC No.	CC-09242018-027

BASIC INFORMATION

REC Code:	06112020-04
Title of the Research Project/Thesis/Dissertation:	**Curriculum Continuity and Progression in Teaching Junior High School Mathematics**
Researcher/Project Leader and Designation/Affiliation:	**Judy V. Bongala**

The following items [√] have been received and reviewed in connection with the above study conducted by the above researcher/principal investigator:

[✓] Thesis

[ ] Dissertation

[ ] Research Article in APA Format

And hereby certified that it has fully complied with the PNU Code of Research Ethics and Guidelines for Review as stipulated in the BOR Resolution No. U-2303 s. 2015.

Date of Issuance: **June 11, 2020**

Dr. TERESITA T. RUNGDUIN (SGD)
Secretary
Research Ethics Committee

Dr. RENE R. BELECINA (SGD)
Chair
Research Ethics Committee

(All documents without the PNU QM Stamp or Control Identifier are uncontrolled)

L Sample Individual Interviews

Teacher 1 | INDIVIDUAL INTERVIEW

Grade levels taught	:	7, 10 (currently teaching grade 10)
Specialization	:	Math
Education	:	CAR-Administration an Supervision
Subject taught	:	Math
Teaching Experience	:	22 years

RQ 1.a: Understanding on Continuity of Math Curriculum

Researcher

How would you describe continuity in the mathematics curriculum?

Interviewee

For me kapag sinabing continuity, the skills must be continuous from grade 7 to the next level, from simple to complicated. But as of now we have the so called K-12. Spiral ang knowledge ng mga bata kaya parang a little of something. Paunti-unti lang na nalalaman nila tapos contuous namn the next year na. Walang mastery para saakin. Yun ang problem ng mga bata ngayon. *[For me when you say continuity, the skills must be continuous from grade 7 to the next level, from simple to complicated. But as of now we have the so called K-12, the knowledge of the students is spiral…seems like a little of everything. They only learn a small portion then to be continued the next year. No mastery for me. That is the problem of the students now.]*

Researcher

Mam nagturo kayo ng grade 7 noon tapos ngayon grade 10, so ano po Mam ang naobserve no noong naggrade 10 na sila? *[Ma'am you taught grade 7 before then now in grade 10, so what do you observe when they already reached grade 10?]*

Interviewee

Ang mga nag-grade 10 ngayon usually ang problem nila is about integers talaga. *[The usual problem of grade 10 now is really on integers.]*

Researcher

Diba po Mam sa grade 7 (na din) sya? *[It is in grade 7, isn't it?]*

Interviewee

Yes. Though dapat may mastery na baga sila. I am really wondering bakit yun ang pinakaproblem nila. *[Yes! Though they should have mastered it already. I am really wondering why that still exist as their problem.]*

Researcher

So papaano po yun Mam? *[So what do you do?]*

Interviewee

So ang ginagawa ko, I need to rcall the rules specially the basic operations. Sabi ko sa kanila, pag alam mo to. Makakapagsolve ka ng complicated pero kapag hindi nyo alam ang basic, talagang mahihirapan kayo.

Teacher 3 | INDIVIDUAL INTERVIEW

Grade levels taught	:	7 (currently teaching grade 8)
Specialization	:	Math
Education	:	MA units
Subject taught	:	Math
Teaching Experience	:	3 years (1 year as Math teacher)

RQ 1.a: Understanding on Continuity of Math Curriculum

Researcher

How would you describe continuity in the mathematics curriculum?

Interviewee

We can only have continuity with regards to teaching mathematics if for that specific school year we are only teaching specific discipline in Mathematics. For example, I am not referring to K-12 here, say for example Algebra, for one school year you should teach Algebra only…that's continuity! However, since, due to K-12 curriculum and the approach is spiral, the topics and content are not continuous.

Researcher

So you mean 'horizontal continuity'.

Interviewee

Yes. All of the content for specific discipline is given to specific grade level.

Researcher

Does it also mean that because we are not just teaching Algebra for 1 school year, so there is a discontinuity?

Interviewee

Yes. There is a discontinuity.

Researcher

How about when it comes to teaching?

Interviewee

When it comes to teaching there is always a continuous process in teaching. Because we teachers always adjust to the curriculum guide. Whatever in the CG, we follow it. So therefore, the teaching is still continuous.

RQ 1.b: Understanding on Progression of Math Curriculum

Researcher

How about progression?

TEACHER 5 | INDIVIDUAL INTERVIEW

Grade levels taught :	8, 9 (currently teaching grade 8)	
Specialization	:	Math
Education	:	BSEd Math
Subject taught	:	Math
Teaching Experience	:	1 year

RQ 1.a: Understanding on Continuity of Math Curriculum

Researcher

How would you describe continuity in the mathematics curriculum?

Interviewee

Pagsinabing continuity, for example grade 7 nagsisimula sa…example sa Algebra, su mga pasil lang. Like yung linear equation in one variable lang pag grade 8 nagto-two variables, quadractic pag grade 9. Garu nagpapadipisil sya para gamiton su mga nakua kang aki na skills sa grade 7 para sa sunod na years. Pero minsan nalilingawan na ninda. Kaya nadidipisilan na ang sunod na teacher. *[When you say continuity, for example, grade 7 will start with…example in Algebra, will start with easy topics. Like the linear equation in one variable, when they reached grade 8, it will become two variables, quadratic when it comes to grade 9. It tends to be complicated so that the previous knowledge from grade 7 will be utilized by the students in the succeeding years. But sometimes they forgot it. That is why it becomes burden to the next teacher.]*

Researcher

Kapag ganoon ano po Sir ginagawa mo? *[So if that's the case what do you do?]*

Interviewee

For example sa factoring, sa factoring kailangan yung mga special products. Nahaluyan kami ta nagreview pa sa special products eh di from the start ulit. Wara na naman sa mga isip kang aki. Madalion mawara. Kaya iyo ito su pangit. Feeling ko kung Algebra lang sa sarong year, tuloy-tuloy ta pare-parehas. Pero ngunyan na iba-iba nagkakarilingawan na su past lessons. *[For example in factoring…in factoring you need special products. We stay long in the review in special products so we start from the beginning. The knowledge didn't stay on their minds. It's easily gone…and this is the ugly thing. I feel that if it is Algebra alone for one school year, it will be continuous because the topics are the same. But now that there are different content they forgot the past lessons.]*

RQ 1.b: Understanding on Progression of Math Curriculum

Researcher

How about progression?

Interviewee

Anong pinagkaiba ng dalawa? Ahm.. Ang progression may progress. Nagdadagdag yung ano (competencies) and nagdidipisil habang nagtataas yung grade level sa math. Pero before ito mameet kailangan nya yung competencies na natutunan nya sa previous years. *[What's the difference between the two? Ahm…In*

TEACHER 7 | INDIVIDUAL INTERVIEW

Grade levels taught : 7, 8, 9, 10 (2nd year in teaching math 8)
Specialization : Math
Education : CAR-Math Ed
Subject taught : Math
Teaching Experience : 23 years

RQ 1.a: Understanding on Continuity of Math Curriculum

Researcher

How would you describe continuity in the mathematics curriculum?

Interviewee

Spiral approach sya and students have little knowledge about Algebra, Geometry, Statistics where in that is also from elementary years. Na kung saan para saakin wala syang mastery on the Part of the students. Kasi konti-konti lang. Walang continuity yung knowledge from simple to complex. Mastop na naman then ang continuation naman ay sa next grade level. *[It is spiral approach and students have little knowledge about Algebra, Geometry, and Statistics where in that is also from elementary years…where in for me there is no mastery on the part of the students. Because it is bit by bit. No continuity of knowledge from simple to complex. They will stop then the continuation will be on next grade level.]*

Researcher

Since nagturo kayo ng 7,8,9 and 10, yung approach nyo Mam sa different grade levels papaano po Mam nacoconect? *[Since you taught 7,8,9 and 10…your approach in different grade levels…how did you connect them?]*

Interviewee

Yung approach from grade 7 to 8? Kasi yung approach ngayon sa grade 8, may mga concepts from grade 7 na kailangan sa grade 8. So before I start the lesson I have to recall the previous knowledge, the prerequisite skills. Importante yung kasi hindi makukuha ng grade 8 yung lesson kung talagang wala silang alam na prerequisite. But sad to say yung recall nay un para sa kanila para na ring new lesson. Kasi matagal na sya. Nakalimutan na. Kaya parang new lesson na din sa kanila. *[The approach from 7 to 8? Because our approach in G 8…there re concepts in Grade 7 that are needed in Grade 8. So before I start the lesson I have to recall the previous knowledge, the prerequisite skills. That is important because they will not be able to achieve Grade 8 lessons if they have no have knowledge on the prerequisites. But sad to say the recall seems to be a new lesson for them…because it has been quite long time…they have forgotten…so it seems to be new lesson for them.]*

RQ 1.b: Understanding on Progression of Math Curriculum

Researcher: **How about progression po Mam?** ***[How about progression Mam?]***

Interviewee

Sa curriculum okay. Kasi nga talagang in progress yung topics, pero when it comes to implementation nagmamatter na yung level ng learners. Kasi parang hindi mo mamimeet yung standard na gusto ng curriculum na in progress talaga yung concepts na makukuha ng bata. Maganda yung curriculum kasi dere-

TEACHER 9 | INDIVIDUAL INTERVIEW

Grade levels taught : Grade 7, 8, 9. Now, 7 & 9
Specialization : BSEd Math
Education: : MA [CAR) in Administration & Supervision, MAT Math [TUP-not finished)
Subjects taught : Physics, Gen Sci, Chemistry, Values, Mathematics

---

Researcher
When you started teaching, was Math one of the subjects you taught?

Interviewee
No. I taught a lot in Values Education, General Science, Physics and also Chemistry. When I was teaching private, all the subjects I handled is in Math. When I taught in college, I handled Math and Filipino.

Researcher
But here in San Lorenzo, how long have you been teaching Math?

Interviewee
I started in 2005. But I started to work as regular-permanent in 2006.

Researcher
Do you already have loads in Math?

Interviewee
I can't remember. It was mixed but maybe 1 load in Math. Not purely Math [teaching loads) when I started here.

Researcher
But now, you are already in the Math Department?

Interviewee
Yes I am.

RQ 1.a: Understanding on Continuity of Math Curriculum

Researcher
Thank you Mam. So these are my questions leading to my objectives. How would you describe continuity in the mathematics curriculum?

Interviewee
So diba ang continuity nagstart sa elementary tapos to senior high pero in my observations okay din sana pero since a little of everything baga bako syang ano..parang wala syang…mastery ng mga students kasi hindi mo syang pwedeng iteach hanggang sa matuto sila just because of the constraint of time kasi syempre you need to finish the module so, since na limited and time hindi mo talaga sya…tska ano parang ituturo mo ngayon kailangan mong ano…kahit hindi pa lahat nakaintindi kasi waterloo naman talaga ng estudyante ang math. So minsan, siguro good for those in the higher sections but if you handle lower secrtions its very hard kasi kung baga di mo sya, hindi mo maadapt yung gustong mangyari na magsisimula sa estudyante. You cannot do that. Kasi kung baga sa ano…minsan ngane inagihan na ninda, lingaw pa. Tinuro mo ngunyan, the next day parang wala na, wara sindang…ano ito…so ang memory ninda very short. *[In continuity…it starts in elementary then to senior high but in my observations it is somewhat okay but since a little of everything it is not…seems like there is no mastery…mastery of the students because you cannot teach them and wait until they learn because of the constraint of time because of course you need to finish the module. So since the time is limited and you cannot…and…you will teach now…you have to…even if the students have not yet understood because (Math) is really a waterloo of the students. So sometimes, maybe, good for those in the higher sections but if you handle lower sections it is very hard because it will not happen…that the learning should start from the students. You cannot do that. Because as you can see…sometimes they are already done with one competency, but then they*

M Sample Focus Group Discussion

CURRICULUM CONTINUITY AND PROGRESSION IN TEACHING JUNIOR HIGH SCHOOL MATHEMATICS

FGD TRANSCRIPTION
August 2019

Researcher: What are the things you consider in planning a lesson? Please list two to three.

Teacher 10: First is curriculum guide, the capacity or the knowledge of the students then the time.
Teacher 2: Students' performance or capacity of the learners.
Teacher 3: Availability of the materials
Teacher 4: Prerequisite skills and strategies
Teacher 5: References
Teacher 6: Previous lessons

Researcher: Why are these important? Let's start with the curriculum guide. Why do you consider the curriculum guide (in planning a lesson)?

Teacher 10: To be guided with the lessons.
Teacher 3: Because it is the curriculum that we have to follow
Teacher 7: We are mandated to follow the curriculum
Teacher 1: We should not deviate from it
Teacher 6: It is the teacher's bible
Teacher 11: It is the heart of making a plan

Researcher: How about for the capacity of the students? Why is it important (to consider)?

Teacher 10: To identify the appropriate strategies

Researcher: How about the time?

Teacher 4: To determine the length of the lesson

Researcher: Why do you consider the prerequisites?

Teacher 6: It is the stepping stone of your next lesson, without the prerequisites you cannot go on with the next lesson. It is just like painting a house without a good context.

Researcher: Any additional answers? Hearing none, let us proceed to references and previous lesson but I think it is related to what Mam Yna explained. Now for the next question: How do you present new lessons to students? Any volunteer who would like to answer?

Teacher 11: You start with the motivation, review of the previous lesson.
Teacher 7: Unlocking of difficulties
Teacher 1: By giving an opener leading to the new lesson.
Teacher 3: By setting first the objectives

Researcher: Since the Mathematics is fragmented, like in Junior High School there is Algebra, Geometry, Statistics and Probability and they are present across grade levels, so how do you connect the lessons with each other?

Teacher 1: Ang curriculum kasi ay spiral, so from grade 7, may algebra sya, basic algebra, then by grade 8 there is also algebra but it is (the level) is higher until grade 9. 'Pag grade 10, ganun din, from simple to complex. (*The curriculum is spiral, so from grade 7, there is Algebra, Basic Algebra, then by grade 8 there is also algebra but it is (the level) is higher until grade 9. In Grade 10, the same as well, from simple to complex.)*

Teacher 7: So we have to relate it with the previous knowledge of the students from the previous years kasi nga fragmented sya. So we have to recall first their previous knowledge from previous years. *(So we have to relate it with the previous knowledge of the students from the previous years because it is fragmented. So we have to recall first theire previous knowledge from previous years.)*

Researcher: So it always starts with a recall?

Teacher 7: Yes.

Researcher: Any other additional information po?
Teacher 10: Clarification Mam doon po sa question mo kung papaano mairelate yung algebra, geometry or connected yung dalawa, from Algebra to Geometry? *(Clarification Ma'am about your question on how to relate the Algebra, Geometry or the two are connected, from Algebra to Geometry?)*

Researcher: Ay hindi po Sir. Algebra Grade 7 to Algebra Grade 8, Algebra Grade 9. *(No Sir. Algebra Grade 7 to Algebra Grade 8, Algebra Grade 9).*
Teacher 10: So tama yung sagot (understanding) ko. *(So my response/understandingwas correct.)*
Researcher: Yes po Sir. *(Yes Sir.)*
Teacher 10: Akala ko kasi sa isang grade level nandyan na yung apat nay an. First quarter Algebra, second Geometry naman. *(Because I thought in one grade level the four components are there. First quarter Algebra, second quarter Geometry.)*

Researcher: No Sir. So okay na po? If so, let's proceed with the third question. How do you assess students' prior learning before starting the lesson? I heard na nagrerecall. *(No Sir. So are we okay? If so, let's proceed with the third question. How do you assess students' prior knowledge before starting the lesson? I heard there is a recall.)*
Teacher 3: Yes.
Researcher: How do you assess the prior learning aside from the given diagnostic test (every start of school year)? Ito kasi before or during the class. *(This one is before or during class).*
Teacher 4: By giving some drills, exercises.
Researcher: Okay. Any other?
Teacher 7: By asking questions.
Teacher 11: Sometimes the review lesson serves as the new lesson again, diba *(right)*?

Researcher: Sometimes it happen na yung review yun na yung lesson? *(Does it happen that your review becomes your lesson?)*
Teacher 11: Yes. We stay long in the review.
Teacher 9: If the students don't have prior knowledge with the lesson, they don't know the lesson.
Teacher 7: Minsan yun na yung lesson mo (the review). *(Sometimes that becomes your lesson.)*
Researcher: Yun ulit ang ilelesson? *(The lesson is repeated?)*
Teacher 11: Yes. Experience nyo yun diba mga teachers? *(Yes. You do experience that teachers, don't you?)*
Teachers: Yes.

Researcher: How often po nangyayari yung ganung scenario? *(How often does that scenario happens?)*
Teacher 2: Most of the time.
Researcher: How about for other teachers?
Teacher 3: Especially in the lower section.

Researcher: So we are having now the comparison of higher and lower section? So kumusta naman po ang sa higher section? *(So how's the higher section?)*
Teacher 2: Same.
Researcher: Minsan ganoon din po? *(Sometimes they are the same.)*
Teacher 7: Yes pero shorter (time). *(Yes but shorter time.)*

Researcher: Ano po yung reasons kung bakit ganoon po? *(What are the reasons why it was like that?)*
Teacher 11: Poor retention.
Teacher 9: Poor mastery.
Teacher 7: Poor study habits.
Teacher 2: Family problems.
Teacher 9: Nutrition.
Teacher 1: Social media influence.

Researcher: How about with your class Teacher (5)?

Teacher 5: Napakarami pong competencies na binibigay sa isang taon. Kaya para bang hindi naman naaattain yung competencies. It is more on quantity than quality. *(There are so many competencies that are given per year. So it seems that the competencies are not attained. It is more on quantity than quality.)*

Teacher 7: Because we are required to finish the competencies.

Researcher: What happens po if the expected competencies were not met? *(What happens if the competencies were not met?)*

Teacher 9: Problem to the next level.

Teacher 3: We are called by our supervisors and we have to stay for summer.

Researcher: May summer teaching? *(There is a summer teaching?)*

Teachers: Yes.

Teacher 4: Power teaching.

Researcher: What is power teaching?

Teacher 4: Simplified approach and activities.

Teacher 9: Pwede man skip the lesson. *(You can skip the lesson.)*

Teacher 3: Lesser activities, more topics.

Teacher 4: Spoon feeding.

Teacher 1. Back to traditional way of teaching.

Researcher: So pagnagkaroon ng problema sa pag-asses, babalik doon sa, I mean, kapag naidentify na di pa sila ready doon sa lesson so yun na yung magiging lesson. So repetitive? *(So when you found out problems during assessmet, you will go back, I mean, when you have identified that they are not yet ready in your lesson, that will be your lesson (prerequisites)?)*

Teachers: Yes.

Researcher. So here, what specific practices or techniques do you employ to help students use their previous knowledge to learn the current lesson? You assessed already that students have learned this, so ano yung techniques or practices nyo po na ginagamit? *(You assessed already that students have learned this, so what are your techniques or practices that you use/do?)*

Teacher 7: Drills.

Teacher 9: Giving activities. Giving assignment.

Teacher 4: Brainstorming among students.

T9: Giving assignments. Para maretain and maenhance mo yung kanilang kinalalagyan by giving an assignment. Pagnagbigay ka ng lesson minsan hindi pa talaga nila masyado alam. Para mapilitan silang mag-aral, bibigyan mo sila ng assignment para magprepare, para mas magstudy sila at maenhance ang kanilang knowledge. *(Giving assignments to retain and enhance their current situation by giving them assignment. When you give lessons, sometimes they really don't know it yet. So that they will be forced to study, you will give them assignment for them to prepare, so they will study and enhance their knowledge.)*

Teacher 10: Follow-ups.

Teacher 7: Giving performance tasks.

Researcher: Do you give students (activities) like listing down the contents or topics na nalesson na sa kanila? *(Do you give student activities like listing down the contents or topics that were given to them?)*

Teacher 7: Nilalagay sa portfolio compiling all the activities. *(They put it in a portfolio compiling all the activities.)*

Researcher: After the grading period?

Teacher 7. Yes.

N Sample Lesson Plans

Region V (BICOL)
SCHOOLS DIVISION OFFICE

S.Y. 2019-2020

LESSON PLAN IN MATHEMATICS 7

July 24,2019(Thursday)

I. OBJECTIVES

A. **Content Standard:** The learner demonstrates understanding of the real number system.
B. **Performance Standard:** The learner is able to formulate challenging situations involving real numbers and solve these in a variety of strategies.
C. **Learning Competencies/ Objectives:** At the end of the lesson, the learner must be able to:
   a. define rational numbers
   b. express rational numbers from fraction form to decimal form,
   c. apply the concepts of rational number in real life situation.
   CODE: (M7NS-Ie-1)

II. SUBJECT MATTER:

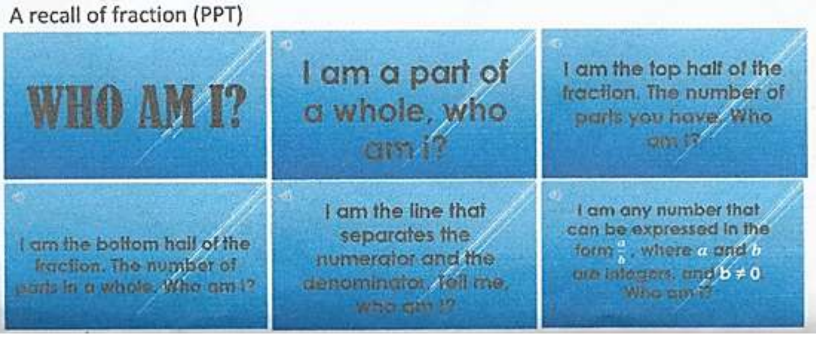
A. **Topic:** Rational Numbers
B. **Skills:** Defining Rational Numbers and Expressing Fraction Form to Decimal Form
C. **Values:** Accuracy, Patience, Teamwork, and Analysis
D. **Materials:** Visual Aids, Chalk and Board, Laptop and Smart TV
E. **Reference:** DepEd Region V Contextualized Prototype Daily Lesson Plans in Mathematics 7 (First Quarter) and Grade 7 Mathematics Patterns and Practicalities by Gladys C. Nivera, Ph. D. pages 76-80

III. PROCEDURE:

A. **OPENER/ MOTIVATION:**
   a. Recapitulation of the last lesson discussed to the class through

"IDENTIFY ME, PROPER-TY"
" Be yourself, stays the same"
"Changing the group and making friends will be okay"
"Change your way, it doesn't matter"
"Your opposite is your identity"
"Give and share equally so that everyone will be happy"

   b. **"WHO AM I"**
   A recall of fraction (PPT)



B. LESSON PROPER

A. ACTIVITY I

The class will be divided into 3 groups. Each group will be given a task to do. One of the members will present their work in front of the class.

GROUP 1 (FOLLOW ME)

Given the example below on expressing fractions to decimal number, please follow the steps to express $\frac{3}{20}$, $\frac{5}{8}$ and $\frac{6}{15}$

1/5

$$5\overline{)1.0} = 0.2$$

10
0

Therefore, $\frac{1}{5} = 0.2$

6/8

$$8\overline{)6.00} = 0.75$$

56
40
40
0

Therefore, $\frac{6}{8} = 0.75$

9/8

$$8\overline{)9.000} = 1.125$$

8
10
8
20
16
40
40
0

Therefore, $\frac{9}{8} = 1.125$

GROUP 2 (CHANGE ME!)

Ms. Joan will buy items in the market. She will buy the following in the list:

Fish :	$\frac{3}{4}$ kg
Onions:	$\frac{9}{10}$ kg
Tomatoes:	$\frac{4}{5}$ kg

But then, in real life, weights of objects do not come in neat fractions like ½ , ¾, and ¼. If she wants to add fractions like those on the list, she will take time and effort. Since, it is far more convenient to work with decimals, express those fractions in decimal numbers?

GROUP 3 (TEACH ME!)

Your brother whose studying in San Lorenzo Elementary School finds it difficult to understand the explanation of the teacher on expressing 3/5 to decimal number. As an elder brother or sister, how will you explain the process on expressing this fraction to decimal number? Explain it in the class.

$$5\overline{)3.0} = 0.6$$

30
0

Therefore, $\frac{3}{5} = 0.6$

ACTIVITY II

Instruction: The class will be divided into 5 groups according to their act they want such as Dancing, Math Hugot, Pick-Up Line, Acronym and Jingle Making . They will be given 15 minutes to express the fractions to decimal numbers.

Groups 1 and 2

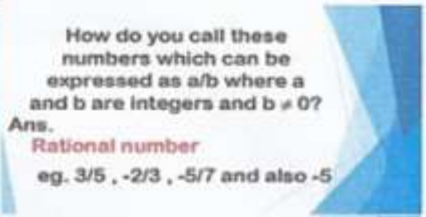
1. 1/8
2. -4/10
3. 7/8
4. 4/5
5. $4\frac{[illegible]}{20}$

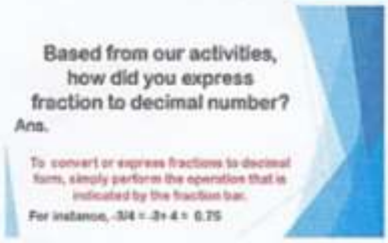
Groups 3,4 and 5

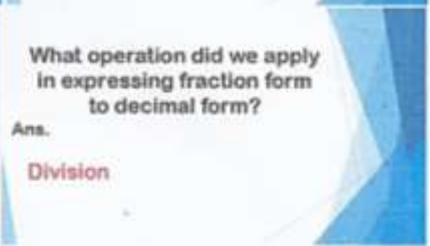
Round off your answer to the nearest hundredths if possible.

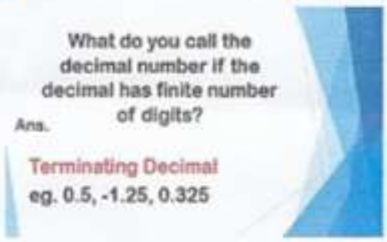
1. -1/9
2. 7/9
3. 11/15
4. -8/11
5. $3\frac{2}{3}$

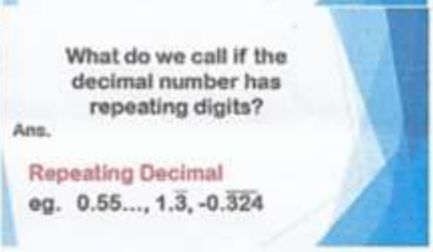
B. ANALYSIS

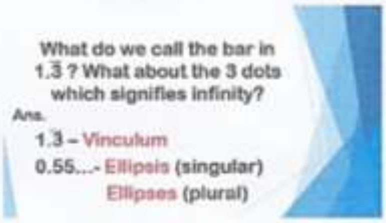












C. ABSTRACTION

1. What is a rational number?
2. How do we express fraction form to decimal form?

D. APPLICATION

Do this☺

Direction. Solve the following problems to complete the phrase below. (By pair). First pair to find t word wins the prize.

R If 12 out of 40 students in the class of Grade 7- Newton of San Lorenzo National High School are boys, then write a decimal for the class that consists of boys.

A Ma'am Jen lives $7\frac{1}{5}$ miles from *Mayon Rest House and Planetarium*. If she wants to vis the place together with the Grade 7- Newton students, how far it is if expressed in decimal number?

O Arcel studied $13\frac{1}{2}$ hours this week as preparation for the upcoming summative test in Math 7. Write the number of hours in decimal.

N Bicol express is one of the Top 10 best native delicacies of Bicol. To make a delicious *Bicol Express* in every ¼ kg of sliced pork belly *(liempo),* there should also be 2/8 kg of finger chili (*siling panigang*), seeded and sliced. Now, what is 2/8 kg of finger chili in decimal number?

G One of the prides of Bicol is the *Abaka* Native Products. It is not impossible since our country is the largest producer of abaca fibers supplying about 87/100 of the world's requirement for the production of industrial applications and others. What is 87/100 in decimal number?

O According to Facebook, 47 out of 100 people rate *KC Land of Tabaco City* as great destination to relax. What do you think is the decimal number of 47/100?

" Mga _____ _____ _____ _____ _____ _____ Kita! ☺"

0.47 0.3 7.2 0.87 13.5 0.25

IV. ASSESSMENT:

Express the following fractions to decimal numbers. (Individual) Show you solution on a ¼ sheet of paper. If repeating decimal, round off to the nearest hundredth.

1. 1/8
2. 5/12
3. -16/20
4. 7/3
5. $1\frac{5}{9}$

V. ASSIGNMENT:

Study expressing decimal numbers to fraction form and give 3 examples.

Prepared by: [redacted]

Teacher I/Mathematics 7 Teacher

Checked by: [redacted]

Head Teacher III/ Department Chairperson- Mathematics

Republic of the Philippines
DEPARTMENT OF EDUCATION
Region V (Bicol)
SCHOOLS DIVISION OFFICE
Tabaco City

S.Y. 2019 – 2020

LESSON PLAN IN MATHEMATICS 8

July 23, 2019 (Tuesday)

I. OBJECTIVES

A. **Content Standard:** The learner demonstrates understanding of key concepts of linear equations in two variables.

B. **Performance Standard:** The learner is able to formulate real-life problems involving linear equations in two variables and solve these problems accurately using a variety of strategies.

C. **Learning Competencies/Objectives:** At the end of the lesson, the learner must be able to;
   - **a.** illustrate the rectangular coordinate system,
   - **b.** give the coordinates of a point on the XY - plane and plot points on the Cartesian plane,
   - **c.** identify to which quadrant or axis does a given point lies, and
   - **d.** appreciate the concept and uses of rectangular coordinate system in real-life situation.
     CODE: (M8AL – Id – 2)

II. SUBJECT MATTER:

A. **Topic:** Rectangular Coordinate System

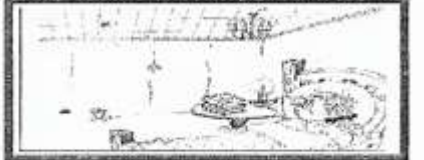
B. **Skills:** Illustrating Rectangular Coordinate System and its Uses, Identifying the Coordinates of Points, and Plotting of points in Cartesian Plane.

C. **Values:** Accuracy, Patience, Analysis

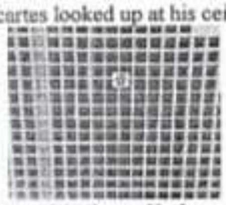
D. **Materials:** Visual Aids, Chalk and Board, Improvised Cartesian Plane, Laptop and Projector, White Board Markers

E. **Reference:** Grade 8 Mathematics Learner's Module, pages 119 – 137.
DepEd Region V Contextualized Prototype Daily Lesson Plans in Mathematics 8 (First Quarter), pages 139 – 145.

III. PROCEDURE

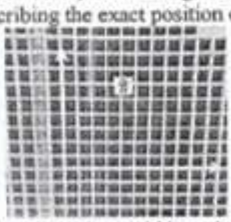
TEACHER'S ACTIVITY	STUDENTS' ACTIVITY
A. ***OPENER/MOTIVATION*** a. Recapitulation of the things happened last meeting.	Everyday there are students who are assigned to give a recap. They must make their recap extra interesting by adding a twist into it. The twist may be a short jingle, a hugot line, an "I believe phrase, a tigsik, a poem, a broadcasting, a short story etc.
b. Story Behind Rectangular Coordinate System  A very famous mathematician called **Rene Descartes** lay in bed one night. As he lay there, he looked up at the ceiling in his bedroom. He noticed a fly was asleep on the ceiling. Descartes, being a mathematician wondered if he could figure out a way of stating where exactly the fly was on the ceiling. Obviously it has to be a precise description he	

thought. I can't really say, "To the left" or "Near the right "or "In the middle".
When Descartes looked up at his ceiling, this is what he saw.



A fly resting there. He began to think about how he might be able to describe the exact position of the fly.

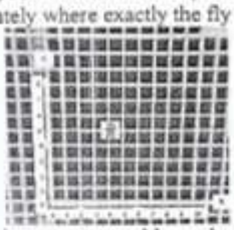
Descartes decided that if he drew two lines at right angles to each other, then he might be able to come up with a way of describing the exact position of the fly.



How do you think this would have helped him?

Descartes may identify how far the fly is from the horizontal line and how far it is from the vertical line.

Descartes decided to place numbers on the bottom (horizontal) row and on the side (vertical) row. He could now state accurately where exactly the fly was on the ceiling.



But there was a problem, should he give the vertical number of tiles first followed by horizontal? i.e. go up 5 squares and move across 4 squares, or should he give the horizontal number first, then the vertical? i.e. go across 4 squares then move up 5?

He decided to give the HORIZONTAL NUMBER FIRST and THE VERTICAL NUMBER SECOND.

To help people remember this he called the horizontal line X and the vertical line Y (Because X comes before Y in the alphabet)

So, in this diagram, the position of the fly can be found by moving 4 units across, then 5 units up.

These are known as X, Y values and are written like this Position of fly = (4, 5).

$$\begin{pmatrix} \text{X value}, & \text{Y value} \\ \text{(First)} & \text{(Second)} \end{pmatrix}$$

In honour of Rene Descartes, the graph showing the coordinates of the fly is known as the Cartesian Plane (or X Y Plane).

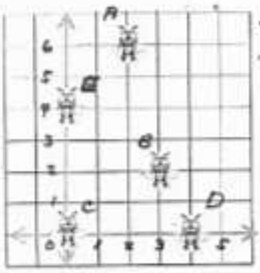
B. LESSON PROPER

a. ACTIVITY I

The class will be divided into 3 groups.
Each group will be given a task to do.

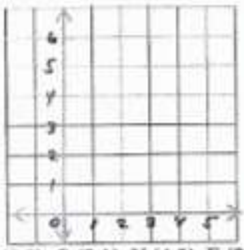
GROUP 1 (Locate the Fly)

Give the coordinates of each fly below.



GROUP 2 (Plot my Points)

Plot the following coordinates in the Cartesian Plane.



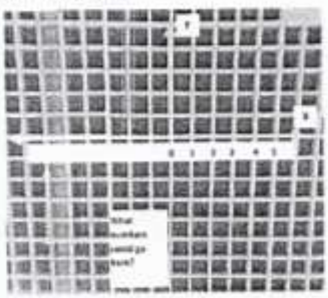
L (2,0); O (3,1); V (4,2); E (3,3);
W (2,2); I (1,3); N (0,2); S (1,1)

GROUP 3 (Complete Me)

For the next part we need to think back to when we did the "Number Line"

Recall what the Number Line looks like

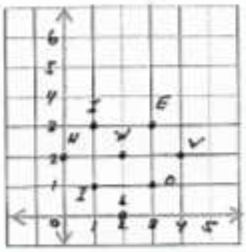
Keeping this in mind, what numbers do you think could go in the "missing parts" of the coordinate plane. Fill them in on the diagram below.



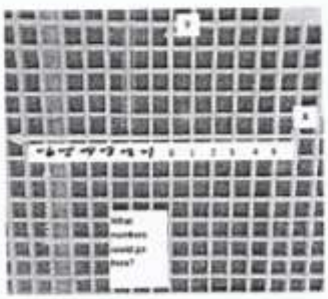
GROUP 1 (Locate the Fly)

A (2,6)
B (3, 2)
C (0,0)
D (4,0)
E (0, 4)

GROUP 2 (Plot my Points)

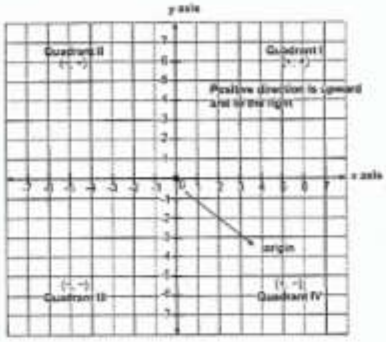


GROUP 3 (Complete Me)



b. ***ANALYSIS*** **In Activity 1** **Group 1 and 2**	
1. How did you identify the coordinates of each fly? How did you get the abscissa? How about the ordinate?	1. The coordinates of each fly was identified getting the x – coordinate first, followed by the y – coordinate. The abscissa is the directed distance of the point from the y – axis and the ordinate is the directed distance of the point from the x – axis.
2. How is a point plotted in the plane?	2. To plot a point, we start at the origin then we move x units horizontally along the x – axis. Then we move y units vertically. Lastly we draw a point and label it.
3. Are the coordinates (0, 2) and (2, 0) the same? Why? Can you plot these points in the plane?	3. They are different points. Because their abscissas are different and so as their ordinates. The order in an ordered pair is important.
4. In what particular part of the Cartesian plane does fly D lye? How about point L?	4. In the x – axis
5. What can you say about the y – coordinates of fly D and Point L?	5. Their y – coordinates are both 0.
6. Point L and fly D are called x – intercepts. Basing from the coordinates and illustration of fly D and point L, how will you describe or define x – intercepts?	6. x – intercepts are points located on the x – axis thus its ordinate is 0.
7. In what part of the xy – plane do the fly E and point N lies?	7. In the y – axis
8. What can you say about the x – coordinates of fly E and point N?	8. Their x – coordinates are both 0.
9. Point N and fly E are examples of y – intercepts. Basing from the coordinates and the illustrations of fly E and point N, what is a y – intercept?	9. y – intercepts are points that lye on the y – axis, thus its abscissa is 0.
10. What is the coordinates of fly C?	10. (0, 0)
11. What can you say about the location of Fly C?	11. It is located at the intersection point of the two axes.
12. The location of fly C is called the origin. Basing from the activity, what could you say about the origin of xy – plane?	12. Origin is the starting point in xy – plane. Its coordinates is (0, 0) and is the intersection of the two axes.
Group 3	
13. How many number lines does a Cartesian plane has?	13. 2 number lines
14. What do you call the two intersecting number lines? the point of intersection?	14. The intersecting number lines are called axes. The horizontal one is x – axis and the vertical line is y – axis. The point of intersection is called the origin.
15. What does the arrow heads in each axis means?	15. It means that each of the axes extends indefinitely on both sides.
In Activity 2	
16. Into how many parts or regions is the plane divided? How do we call these regions?	16. 4 regions. Each region is called quadrant.
17. How can you describe a quadrant? How are you going to label/name these quadrants?	17. A quadrant is a quarter of a Cartesian plane. Quadrants are labeled as quadrant 1 – 4 in counter clockwise direction. Where quadrant I is the upper right quarter of xy – plane.
18. Given the coordinates of a point, how will you identify whether it is located in Quadrant 1? Quadrant 2? Quadrant 3? or Quadrant 4?	18. Location -- Sign of the Coordinates QI -- (+, +) QII -- (-,+) QIII -- (-, -) QIV -- (+, -)
c. ***Abstraction*** 1. What are the parts of Rectangular Coordinate System?	Parts of Rectangular Coordinate System a. Axes - x- axis and y – axis

b. Origin (0,0)
c. Quadrants (I, II, III, IV)
d. x – intercepts (x, 0)
e. y – intercepts (0, y)
f. point (x, y)



2. How do you plot points in Cartesian Plane?

2. To plot a point, we start at the origin then we move x units horizontally along the x – axis. Then we move y units vertically. Lastly we draw a point and label it.

3. How do you identify the coordinates of a plotted point in an xy – plane?

3. To identify the coordinates of a point, we first identify the x – coordinate, followed by the y – coordinate. The abscissa is the directed distance of the point from the y – axis and the ordinate is the directed distance of the point from the x – axis.

4. How do you identify to which quadrant or axis does a particular point lies?

Location -- Sign of the Coordinates

1. QI -- (+, +)
2. QII -- (-,+)
3. QIII -- (-, -)
4. QIV -- (+, -)
5. x – axis -- (x, 0)
6. y – axis -- (0, y)
7. origin -- (0, 0)

*d. **Application***

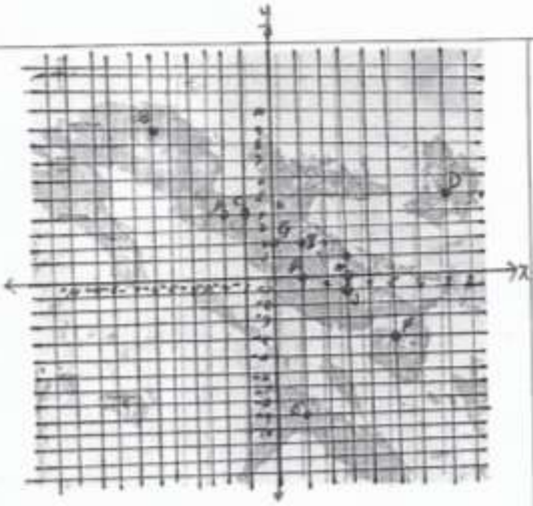
To complete the lyrics of an excerpt from the Bicol Regional March below, find the coordinates of the given point that correspond to the missing lyrics of the song.

Bicolandia! Bicolandia!
Our native land, behold!
__A__, __B__, __C__,
__D__, __E__, __F__
Cities of __G__, __H__, __I__,
__J__, __K__, __F__ and
__E__.

Abode of noble heroes, land of the free
Oh! __L__ is watching over thee.

Bicolandia! Bicolandia!
Our native land, behold!
Albay, **Camarines Norte**, **Camarines Sur**,
Catanduanes, **Masbate**, **Sorsogon**.
Cities of **Iriga**, **Naga**, **Ligao**, **Legazpi**, **Tabaco**,
Sorsogon and **Masbate**.

Abode of noble heroes, land of the free
Oh! **Mount Mayon** is watching over thee.



(7, 5) Catanduanes
(5, -4) Sorsogon
(-6, 9) Camarines Norte
(1, 0) Albay
(1, -5) Masbate
(-1, 4) Camarines Sur
(1, 2) Ligao
(3, 0) Mt. Mayon
(-2, 4) Naga
(3, -1) Legazpi
(0, 2) Iriga
(3, 1) Tabaco

IV. ASSESSMENT

HUMAN RECTANGULAR COORDINATE SYSTEM (Simulation)

Form two lines, a horizontal line (x-axis) and a vertical line (y-axis). These lines should intersect at the middle. Others may stay at any quadrant separated by the lines. You may sit down and will only stand when the coordinates of the point, the axis or the quadrant you belong to is called.

V. ASSIGNMENT

Bring graphing paper, ruler, pencil and coloring Materials tomorrow. (Performance task: CoordenART)

CONGRATULATIONS! You presented your lesson systematically + great. KEEP IT UP!!!

Prepared by:

[redacted]
Teacher I/Mathematics 8 Teahcer

Checked by: / Observed:

[redacted]
Head Teacher III/Department Chairperson - Mathematics

School:	[redacted]	**Grade Level:**	***Grade 10 - Accountability***
Teacher:	[redacted]	**Learning Area:**	***Mathematics***
Teaching Date & Time:	*July 9, 2019 Tuesday* *7:15 - 8:15*	**Quarter:**	***First Quarter***

I-	**OBJECTIVES**		
	A.	Content Standard	*The learner demonstrates understanding of key concepts of sequences.*
	B.	Performance Standard	*The learner is able to formulate and solve problems involving sequences in different disciplines through appropriate and accurate representations.*
	C.	Learning Competencies/Objectives Write the LC code for each	M10AL-Ie-1 The learner determines geometric means and nth term of a geometric sequence.
II -	**CONTENT**		Define geometric means. Find the geometric means of a geometric sequence.
III -	**LEARNING RESOURCES**		
	A.	References	
		1. Teacher's Guide pages	*page 24*
		2. Learner's Material pages	*page 30*
		3. Textbook pages	*McGraw-Hill Our Math 10,pages 37 -40*
		4. Additional materials from learning Resources (LR) portal	
	B.	Other Learning Resources	visual materials, activity materials, board and marker, etc.
IV -	**PROCEDURES**		
		ENGAGE	Find the missing terms in each geometric sequence from the box below. 1. 3, 12, 48, __, __ 2. __, __, 32, 64, 128, ... 3. 5, __, 20, 40, __ 8 -2 16 -80 768 80 -8 192 1/2 10
	A.	Reviewing previous lessons or presenting the next lesson	Students will be called to answer on the board and the others will be waving their hands whenever the answer is correct.
	B.	Establishing a purpose of the lesson	Sometimes, we are given two terms of a geometric sequence, but they are not consecutive terms.
	C.	Presenting examples/instances of the new lesson	Geometric means are the terms between two given terms of a geometric sequence. Examples: 1. 3, <u>12</u>, <u>48</u>, <u>192</u>, 768 2. 8, <u>16</u>, <u>32</u>, <u>64</u>, 128 3. 5, <u>10</u>, <u>20</u>, <u>40</u>, 80
		EXPLORE	Finding the geometric means between terms of a geometric sequence
	D.	Discussing new concepts and practicing New Skill #1	*Example 1: Find the three geometric means between 5 and 3125.* *Example 2. Find the two geometric means between 2 and 250.* *Solution:* *Step 1: Illustrate the geometric sequence and list down the given.* *Step 2: Find the common ratio r by substituting the given values to the nth term of geometric sequence.*
	E.	Discussing new concepts and practicing New Skill #2	*Step 3: Find the indicated number of geometric means using the obtained value/s of r.* *Step 4: Write down the geometric sequence/s obtained and the geometric means.*

EXPLAIN		Find the geometric means in each sequence. 1. 1, ___, ___, 8 2. 0.25, ___, ___, ___, 64 3. 0.20, ___, ___, ___, 125 ** A rubric will be used on assessing the performance of group activity.* *Numbered Heads Together: All members from each group will be numbered as 1 to 9. The teacher will randomly pick the group number and the numbered head that will present their work in front.*
F.	Developing Mastery (Leads to Formative Assessment 3)	
ELABORATE		Dustin is saving money from his summer job to buy a new pair of shoes. He saved Php 50.00 the first week and Php 400.00 after the fourth week. How much did Dustin save for the 2nd and 3rd week? *Values integration: Being thrifty, responsible, and persevering*
G.	Finding practical application of concepts and skills in daily living	
H.	Making generalizations and abstractions about the lesson	What are geometric means? How do we find the geometric mean/s of a geometric sequence? Give the steps.
EVALUATE		Find the geometric means of each geometric sequence. 1. 32, 16, 8, 4, 2, 1 2. 4, 12, 36, 108 3. 6, ___, ___, 162
I.	Evaluating Learning	
EXTEND		Answer Activity 10: Finding Geometric Means in Math 10 Learner's Material page 41.
J.	Additional activities for application or remediation	
V.	**REMARKS**	
VI.	**REFLECTIONS**	
A.	No. of learners who earned 80% in the evaluation	
B.	No. of learners who require additional activities for remediation who scored below 80%	
C.	Did the remedial lesson work? No. of learners who have caught up with the lesson	
D.	No. of learners who continue to require remediation	
E.	Which of my teaching strategies worked well? Why did these work?	
F.	What difficulties did I encounter which my principal or supervisor can help me solve?	
G.	What innovation or localized materials did I use/discover which I wish to share with other teachers?	

DAILY LEARNING LOG

I. OBJECTIVES:	Date : July 08, 2019 Session No. ________ Grade & Section : 10-C, 10- D, 10-G, 10-H
A. Content Standards:	The learner demonstrates understanding of key concepts of sequences.
B. Performance Standards:	The learner is able to formulate and solve problems involving sequences.
C. Learning Competencies:	At the end of the lesson, the students should be able to: • Give the rule of a geometric sequence. • Find the nth term of a geometric sequence using the rule. (M10 AL-1e-1)
II. CONTENT:	**SEQUENCES (Geometric Sequence)**
III. LEARNING RESOURCES:	
1. References	
2. Teacher's Guide Pages	Page 23-24
3. Learner's Guide Pages	Pages 28-29
4. Textbook Pages	
5. Additional Material from Learning Resource Material	
5. Other Learning Sources	Intermediate Algebra, pp. 186-187
IV. PROCEDURES:	
A. ENGAGE:	
1. Reviewing previous lesson/Presenting the new lesson.	**A. Priming Activity** • Prayer • Checking of Attendance • Motivation/Recall **(I'LL TELL YOU WHAT YOU ARE, OK?)** State/give what is asked in the following questions. a. It is a kind of sequence with a common ratio. b. What letter is used to represent the common ratio? c. It is a symbol used to represent the first term of a sequence. d. What does a_n represent? e. What is the general rule of a geometric sequence?
3. Presenting examples/instances of the new lesson	** What is the 10^{th} term of the geometric sequence 8, 4, 2, 1. . . ? Solution: $a_n = a_1 r^{n-1}$ $a_1 = 8$ $a_{10} = 8(1/2)^{10-1}$ $r = ½$ $a_{10} = 8(1/2)^9$ $n = 10$ $a_{10} = 8(1/512)$ $a_{10} = ?$ $a_{10} = 8/512$ $\mathbf{a_{10} = 1/64}$
B. EXPLORE:	
Activity #1	**(CAN YOU FIND ME?)** ***The class is divided into 4 Learning Teams. *** Each team is given a problem to be solved written in an activity card. **Learning Team 1**: Find the 7^{th} term of a geometric sequence 3, 15, 75, . . . **Learning Team 2:** What is the 6^{th} term of a geometric sequence whose first term is 8, and the common ratio is 1/3? **Learning Team 3:** Find the 9^{th} term of a geometric sequence -3, 6, -12, . . . **Learning Team 4:** What is the 5^{th} term of a geometric sequence whose first term is 4, and the common ratio is 1/2 ?
C. EXPLAIN:	

1. Discussing new concepts and practicing new skills #1	*** Answer the guide questions (by Learning Team). • What is your a_1? • How about the **r**? • What is the value of **n**? • What is the **nth term** of your geometric sequence? Show your solutions.
2. Discussing new concepts & practicing new skills # 2	****Presentation of output by a representative from each Learning Team.
3. Developing Mastery	*** Write the first four terms of the geometric sequence where $a_1 = 5$ and $r = -2$.
D. ELABORATE:	
1. Finding practical application of concepts & skills in daily living.	
2. Making generalizations & abstractions about the lesson.	***What is the rule of a geometric sequence? *** How do we find the **nth term** of a geometric sequence using the general rule?
E. EVALUATE:	
1. Evaluating learning	****Directions: Read each item carefully and encircle the letter of the correct answer.** A. Given the geometric sequence 2, 4, 8, 16.... 1. What is the value of a_1? a. 2 b. 4, c. 8 d. 16 2. What is the common ratio ? a. 4 b. 3 c. 2 d. 1/2 3. Find the 7^{th} term a. 64 b. 32 c. 256 d. 128 B. If a geometric sequence has $a_1 = -3$, and $r = 2$, 4. Find the 5^{th} term a. -24 b. -48 c. -12 d. -36 5. What is the value of n in #4? a. 2 b. 3 c. 4 d. 5
F. ELABORATE:	
1. Additional activities for application or remediation	Solve: • Find **r** in a geometric sequence if the first term is 1/3 and the eighth term is 128/3? • What term is 2916 in the geometric sequence 4, 12, 36, ... ?
REFLECTION:	
A. No. of learners who earned 80% in the evaluation	
B. No. of learners who require additional activities for remediation who scored below 80%	
C. Did the remedial lesson work? No. of learners who caught up with the lesson	
D. No. of learners who continue to require remediation.	
E. Which of my teaching strategies worked well? Why did these work?	
F. What difficulties did I encounter which my principal or supervisor can help me solve?	
G. What innovation or localized materials did I use/discover which I wish to share with other teachers?	

Prepared by:

Teacher

Inspected/Noted:

Head Teacher III/Dept. Chairman-Mathematics

O Hand Coding Samples

Research Question: What are the teachers' understanding and view of continuity and spiral progression? From the individual interview question:

Partici pant	How would you describe continuity in the mathematics curriculum?	How would you describe progression in the mathematics curriculum?	What is your view of continuity and spiral progression approach in teaching math?
1	- Presence of skills from grade 7 to the next grade level (understanding) - Simple to complicated - Problem on integers - Recall the previous lesson (tackled several years back) - Poor retention - Continuity of learning is shown by the ability of the students to relate or connect previous knowledge with the new topic	- Improvement; learning more and more (und) - Average learning progression	- A little of something - No mastery of learning - Small retention - Students lose focus - Pro to fast learners but difficult for the slow learners to cope up
2	- Continuous learning of students from grades 7 to 10 (und) - Continuous curriculum but the learning is slow but slow - Topics are cut - Unending prerequisites/review (burden to teachers) - Gaps in topics (sets in Grade 7 then will be continued in Grade 10; no sets in grades 8 & 9) - Students easily forgot; seems to be a new lesson for them (for lower section) - Affected by the different learning ability of the students - Interruptions affects the coverage of the competencies for continuity: Quality vs Quantity - Teachers choose quality teaching but consume much of their time - Use of Budget of Works to unpack the remaining competencies and proportionate time using Power Teaching as a teaching strategy. In power teaching, the activities are simplified, limit or avoid exploratory and discovery approach - It takes a year or more to continue the next content standards	- Increased learning (und) - Slight; very slow - Grade 10 students struggling on operations on signed numbers	- "Maganda if magtuturo sa higher section" - Effective for higher section because their learnings tend to mature "fast" and has good memory retention - A little of something (pakonti-konti) - No mastery - Unpredicted trend in grading per quarter due to students' varied performance per discipline - Transition between math areas confuse students

RQ1: What are the teachers' understanding of continuity & spiral progression?
- How would you describe cur. continuity in the math curriculum?

CONTINUITY

- skills from grade 7 to the next grade level
- Continuous the next year na [VERTICAL CONTINUITY]
[the teacher perceives the vertical continuity of the skills which give rise to non-mastery of the skills because the continuation will be on the next grade level).

PROBLEM
- PROOF: Problem on integers (operations)
Therefore: The vertical continuity is seen less effective - the topic 'operations on integers' has been present from grades 7 to 9 yet not mastered when students turned grade 10)

- PROOF OF DISCONTINUITY:
- review as new lesson - unable to connect/relate previous lessons - even simple recall

- The GAP exist due to different learning abilities of the students.

- "nabobagal ang proseso"
- Discontinued learning of students (on students' part)

$\boxed{\text{CG ok - students not}}$

- simple to complicated [PROGRESSION]

- continuous learnings (competencies)
- difficult to perceive &
CHALLENGE achieve continuity because you have to cut the lessons and will continue them in their grade 8.
unending prerequisites.
- [CONTINUITY OF THE LEARNING EXPERIENCES]
is difficult to achieve
PROBLEM
- Example: Grade 7 - sets
Grade -10 sets
there exist a gap
- Not smoothly continuous
Grade 7 jump to grade 10
[8 - 9 → gap]
- But in other topics, okay
PROBLEM
- Re - mastery - amnesia
- Always a new - lesson
CHALLENGE the competencies / skills in the CG is continuous but the learning process is slow.
- there are certain topics that are present to the continuation is found after 1 or 2 grade levels have passed

UNDERSTANDING

- CG is continuous – classroom setting NOT
  pause
  reason: In the CG, it is not indicated
  the holidays, interruptions (usual school
  activities like intrams, nutrition month, etc.)
  Topics are unpacked — in CG, only
  quarter-specific
  effect: delayed lessons
  Expectation:
  ~~Consequence~~: The DepEd expect them
  to finish all the competencies to make
  it continuous.
- DepEd's view – finishing the competencies
  means/leads to continuity.

PROBLEM:

Choose between QUALITY or QUANTITY

(3) CONTINUITY

- teaching specific discipline in math per
  grade level (as in BEC)
- not in K-12
  cause: We are not just teaching Algebra for
  1 school year – Algeb/Geom/Stat

CONTINUITY IN TEACHING (ADAPTATION)

"– there is always" because teachers
adjust

(4)

CONTINUITY

- Topics – "there is a bit of
  lacking gaps because of
  many competencies for each
  quarter."
- K-12 – no mastery
  BEC – mastery
  "boxed with the competencies
  that must be tackled"
- no mastery because they are
  boxed they have to rush to
  finish the competencies
  ↳ topics not properly discussed

Poor foundation on learning progression

Grade 9 trigo
Grade 10 no trigo
Senior High w/ trigo

GAP IN THE CONTINUITY OF TOPICS

- not finished

SOLUTION: POWER TEACHING
↓
- limit students' activities
- simplified approach
- less to no discovery/explanatory/experimental
  approach/collaborative as
  they are time consuming
Because they are pressured by the
learning competencies in CG

P Coding Samples Using Nvivo 12

NAME: UNDERSTANDING ON CONTINUITY

<Files\\1. Teacher 1> - § 2 references coded [0.52% Coverage]

Reference 1 - 0.38% Coverage
skills must be continuous from grade 7 to the next level

Reference 2 - 0.14% Coverage
simple to complicated

<Files\\2. Teacher 2> - § 4 references coded [0.84% Coverage]
Reference 1 - 0.19% Coverage
the learnings are continuous from grades 7 up to grade 10

Reference 2 - 0.15% Coverage
It is continuous but the problem is it is slow

Reference 3 - 0.32% Coverage
Where is the continuity there of the topic (sets) when in fact it is not found in grades 8 and 9

Reference 4 - 0.19% Coverage
cover all (the competencies) for it to become continuous

<Files\\3. Teacher 3> - § 2 references coded [2.03% Coverage]

Reference 1 - 0.57% Coverage
we are only teaching specific discipline in Mathematics

Reference 2 - 1.46% Coverage
For example, I am not referring to K-12 here, say for example Algebra, for one school year you should teach Algebra only…that's continuity!

<Files\\4. Teacher 4> - § 1 reference coded [0.25% Coverage]
Reference 1 - 0.25% Coverage
continuity of topics in the K-12 spiral curriculum

<Files\\5. Teacher 5> - § 1 reference coded [1.18% Coverage]

Reference 1 - 1.18% Coverage
It tends to be complicated so that the previous knowledge from grade 7 will be utilized by the students in the succeeding years

<Files\\6. Teacher 6h> - § 1 reference coded [1.74% Coverage]

Reference 1 - 1.74% Coverage
Continuity is the continuous process of whatever the student started since grade 7 until grade 12

<Files\\8. Teacher 8> - § 1 reference coded [0.10% Coverage]

NAME: UNDERSTANDING ON PROGRESSION

<Files\\1. Teacher 1> - § 2 references coded [0.27% Coverage]
Reference 1 - 0.07% Coverage
improvement

Reference 2 - 0.20% Coverage
they must learn more and more

<Files\\2. Teacher 2> - § 1 reference coded [0.18% Coverage]
Reference 1 - 0.18% Coverage
The students' learnings increases as they get promoted

<Files\\3. Teacher 3> - § 2 references coded [2.08% Coverage]
Reference 1 - 0.19% Coverage
simple to complex.

Reference 2 - 1.90% Coverage
There will be progression or the students will be progressive in their learnings if they were able to catch up the simplest so that they can advance to the next level of mathematics.

<Files\\5. Sir Chan> - § 2 references coded [1.55% Coverage]
Reference 1 - 0.79% Coverage
an increase (competencies) and becomes more difficult while the grade level increases

Reference 2 - 0.77% Coverage
before they meet that they need competencies taught to them from the previous years

<Files\\6. Mam Ynah> - § 1 reference coded [0.79% Coverage]
Reference 1 - 0.79% Coverage
knowing the last topic that the teacher took

<Files\\7. Mam Weng> - § 1 reference coded [0.43% Coverage]
Reference 1 - 0.43% Coverage
In a way yes, because from simple to complicated

<Files\\8. Mam Malyn> - § 1 reference coded [0.05% Coverage]
Reference 1 - 0.05% Coverage
simple to complex

<Files\\9. Mam Malou Borja> - § 1 reference coded [0.41% Coverage]
Reference 1 - 0.41% Coverage
What we call progression is the spiral, because it is "a little of everything"

VIEW ON CONTINUITY AND SPIRAL PROGRESSION

<Files\\1. Teacher 1> - § 6 references coded [2.98% Coverage]

Reference 1 - 1.09% Coverage

the knowledge of the students is spiral…seems like a little of everything. They only learn a small portion then to be continued the next year. No mastery for me

Reference 2 - 0.08% Coverage

no mastery

Reference 3 - 0.39% Coverage

The concepts are bit by bit. The concepts just take tums.

Reference 4 - 1.06% Coverage

I prefer more (the old curriculum) because there is mastery that gets into the students. Now in the spiral, very small knowledge is retained to students.

Reference 5 - 0.13% Coverage

Students lose focus

Reference 6 - 0.24% Coverage

Oh yes! It is pro to fast learners.

<Files\\2. Teacher 2> - § 16 references coded [6.07% Coverage]

Reference 1 - 0.15% Coverage

It is continuous but the problem is it is slow

Reference 2 - 0.33% Coverage

It seems to be okay in grade 7 however the problem in K-12 is that it will be cut for grade 8 topics

Reference 3 - 0.14% Coverage

there exist a gap on the part of the lesson

Reference 4 - 0.32% Coverage

Where is the continuity there of the topic (sets) when in fact it is not found in grades 8 and 9?

Reference 5 - 0.28% Coverage

In other lessons, it is continuous. There are topics found in grades 7, in 8, 9 and 10

Reference 6 - 0.36% Coverage

It is somehow continuous. The problem of the students is that it seems that their process of learning is slow

Reference 7 - 0.28% Coverage

A lot were scarified. You will choose: quality over quantity or quantity over quality?

Reference 8 - 0.22% Coverage

Yes there is. There is a progression. But in Math, it is very slow.

Reference 9 - 0.23% Coverage

In positive, the idea is good is you will to teach in higher section.

Reference 10 - 0.55% Coverage
In the higher section whatever you say, most especially those who are interested in Math, you will give them basic topics, as time goes by they become mature in Math

Reference 11 - 0.12% Coverage
It was cut (lessons were fragmented)

Reference 12 - 0.93% Coverage
There is mastery in that because if it is Geometry, then (for the whole school year) it will be Geometry starting with lines, basic concepts. Automatic they will not forget expecially those in the middle sections and below because there is continuity (continuity is easily seen).

Reference 13 - 0.40% Coverage
Not like before, if it is Geometry then it will be Geometry, at least there is could be a recall for yesterday's (topic)

Reference 14 - 0.58% Coverage
Even students they are confused. "We just had Algebra then we'll now have Geometry." Then long before it will be retackled because some topics are good for the next grade.]

Reference 15 - 0.86% Coverage
No. Your lesson plan is for Grade 8…but in the implementation, there is an input from the previous lessons…and the problem is, instead of exploratory in Math, you will let the derive, solve non-routine problems, what happened is spoon feeding, basic problems.

Reference 16 - 0.31% Coverage
It turns out to be spoon feeding because if you will let them explore, they don't know anyway.

<Files\\3. Teacher 3> - § 6 references coded [7.42% Coverage]

Reference 1 - 0.57% Coverage
we are only teaching specific discipline in Mathematics

Reference 2 - 2.59% Coverage
For example, I am not referring to K-12 here, say for example Algebra, for one school year you should teach Algebra only…that's continuity! However, since, due to K-12 curriculum and the approach is spiral, the topics and content are not continuous.

Reference 3 - 0.32% Coverage
Yes. There is a discontinuity.

Reference 4 - 0.68% Coverage
it is not that good, the continuity of the discussion is affected

Reference 5 - 1.67% Coverage
there is no continuity of their knowledge, with regards to that specific discipline because we have to move-up, to cut and move to another area of discipline.

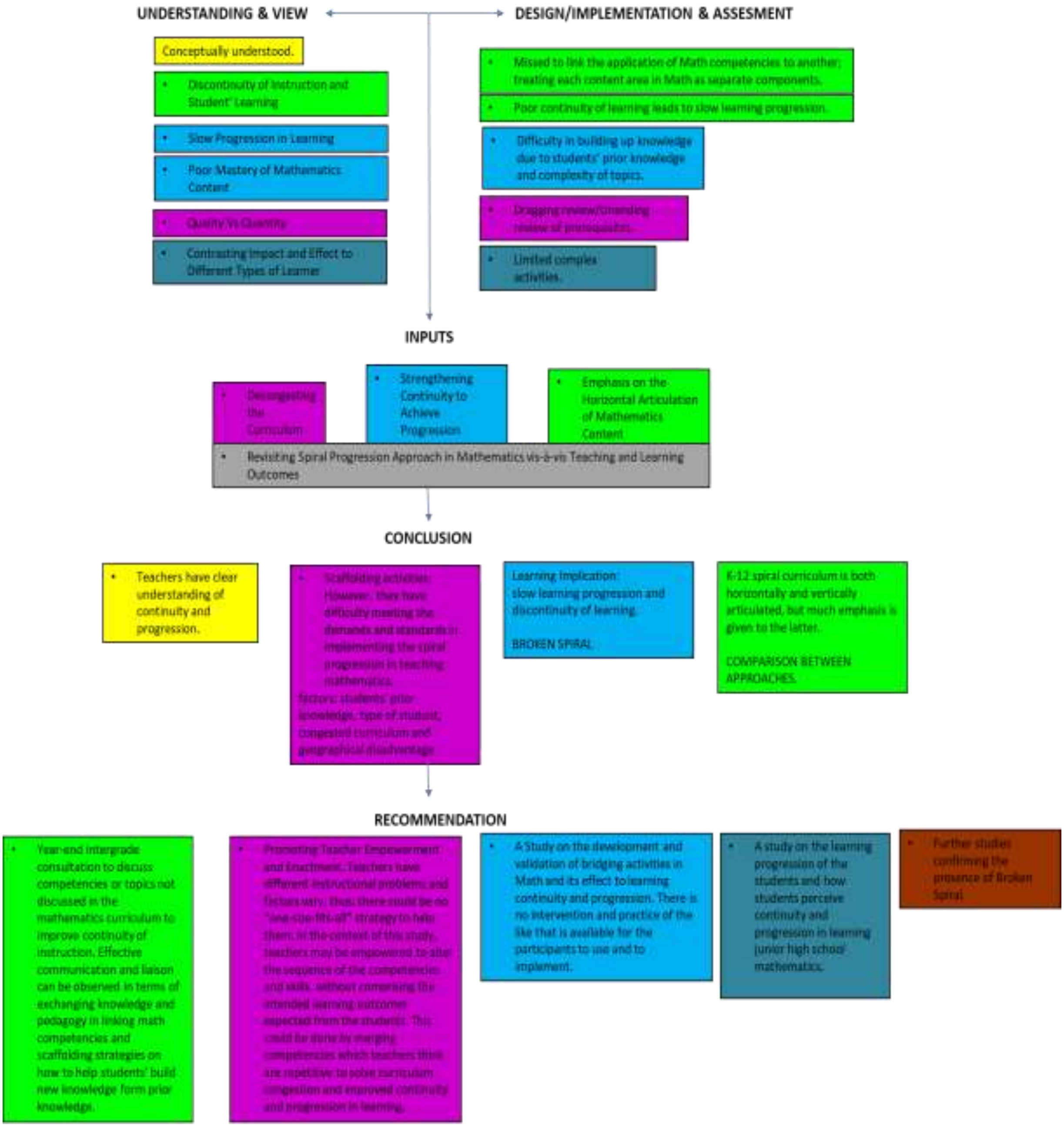
Reference 6 - 1.58% Coverage
Because the CG is very idealistic…that we have to really follow that each competency is for one day. Then the next day another competency. No follow-up.

Q Documentations during Class Observations

R CLASS INTERRUPTION/SUSPENSION FROM JUNE-DECEMBER 2019

June	Dates	Reason	Source
July	16	Tropical Depression Falcon	DZGB News Online Facebook Page https://m.facebook.com/story.php?story_fbid=940279112995291&id=186036045086272
August	22	Heavy rains	Gov. Al Francis Bichara Facebook Account https://m.facebook.com/story.php?story_fbid=738431999928299&id=100012845169691
Sept	2	Special non-working holiday Simeon Ola Day/ Albay Day	Walang Pasok Updates Facebook Page https://m.facebook.com/story.php?story_fbid=1085393134990908&id=637712886425604
Oct	28	Heavy rains	Raul Roi Borejon Facebook Account (Radio Anchor) https://m.facebook.com/story.php?story_fbid=2450328691959766&id=100009479783089
Nov	13	Tropical Depression Ramon	Gov. Al Francis Bichara Facebook Account https://m.facebook.com/story.php?story_fbid=2331763490468653&id=100009050759017
Dec	2-8	Typhoon Tisoy	Gov. Al Francis Bichara Facebook Account https://m.facebook.com/story.php?story_fbid=2867534653279848&id=166082723425068 https://m.facebook.com/story.php?story_fbid=2876429282390385&id=166082723425068

S MAPPING OF RESULTS, CONCLUSIONS AND RECOMMENDATIONS



Understanding	View	Implementation	Inputs	Conclusion	Recommendation
The vertical articulation of topics using the spiral curriculum is clear to mathematics teachers. They described continuity as the presence of common skills, topics or competencies from one grade level to another and the utilization of previous concepts for succeeding lessons. Progression in the curriculum was described as the arrangement of topics and competencies with increasing difficulty. The participants described that teaching in spiral progression approach is giving "a little of everything" to students. The following themes emerged on teachers' view on continuity and spiral progression in teaching JHS mathematics.	*Discontinuity of Instruction and Student' Learning* *Slow Progression in Learning* *Poor Mastery of Mathematics Content* *Choosing between Quality Teaching and Quantity of Competencies* *Contrasting Impact and Effect to Different Types of Learner*	Dragging review/Unending review of prerequisites. Difficulty in building up knowledge due to students' prior knowledge and complexity of topics. Missed to link the application of Math competencies to another and treat each content area in Math as separate components affecting the continuity of their instruction. Limited activites of increasing complexity due to time bound. Poor continuity of learning leads to slow	Decongesting the Curriculum Strengthening Continuity to Achieve Progression Emphasis on the Horizontal Articulation of Mathematics Content OVERALL: Revisiting Spiral Progression Approach in Mathematics vis-à-vis Teaching and Learning Outcomes	Teachers have clear understanding of continuity and progression. Use scaffolding strategies; However, they have difficulty meeting the demands and standards in implementing the spiral progression in teaching mathematics. Bruner's 2nd and 3rd key principles such as knowledge build-up from students' prior knowledge and moving from simple to complex task were challenging for teachers to implement due to the following identified factors: students' prior knowledge, type of student, congested curriculum and geographical disadvantage causing class suspensions and unfinished curriculum at the end of school year. These factors were perceived by the teachers to have learning implications to students' learning such as slow learning progression and discontinuity of learning. These are characteristics of a Broken Spiral introduced by Orale and Uy (2018) to which teachers perceive its existence. In general, the participants have a negative perception	Year-end intergrade consultation to discuss competencies or topics not discussed in the mathematics curriculum to improve continuity of instruction. Effective communication and liaison can be observed in terms of exchanging knowledge and pedagogy in linking math competencies and scaffolding strategies on how to help students' build new knowledge form prior knowledge. Promoting Teacher Empowerment and Enactment. Teachers have different instructional problems and factors vary, thus, there could be no "one-size-fits-all" strategy to help them. In the context of this study, teachers may be empowered to alter the sequence of the competencies and skills, without comprising the intended learning outcomes expected from the students. This could be done by merging competencies which teachers think are repetitive to solve curriculum congestion and improved continuity and pprogression in learning. A Study on the development and validation of bridging activities in Math and its effect to learning continuity and progression. There is no intervention and

		learning progression.		of spiral progression approach in teaching Math. This study found out that some teachers missed to link the application of Math competencies to another. Participants treat each content area in Math as separate and fragmented components affecting the continuity of their instruction. K-12 spiral curriculum is both horizontally and vertically articulated, but much emphasis is given to the latter. With teachers' experience of teaching mathematics using the disciplined-based and spiral approach, they perceive that spiral approach brought negative impact to teaching and learning mathematics. They find the former more appropriate in targeting mastery of competencies and continuity and progression in teaching and learning Math is perceived to be better addressed.	practice of the like that is available for the participants to use and to implement. A study on learning progression of the students and how students perceive continuity and progression in learning junior high school mathematics. Further studies confirming the presence of Broken Spiral.

T VALIDATION RUBRIC FOR RECOMMENDATION

Modified from Bas Swaen (Published on 2016, revised 2020)

Score
1=Not Acceptable (major modifications needed)
2=Below Expectations (some modifications needed)
3=Meets Expectations (no modifications needed but could be improved with minor changes)
4=Exceeds Expectations

Recommendation	Criteria	1	2	3	4	Comments/Suggestions
(Each recommendation was evaluated using the criteria.)	Concrete and specific.					
	Connected to the conclusion.					
	Supported with clear rationale.					
	Contains active verbs.					
	The concerned people can implement the recommendations/measures in a reasonable time.					
	The recommendations clearly indicate what should be done and by whom.