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# Teaching strategies, teaching assessment, and spiral progression curriculum in Mathematics in Divine Word College of San Jose

Gaudier, Marleen Ann E. ✉
*Divine Word College of San Jose, Philippines (anngaudier.0120@gmail.com)*
Jarabata, Chona T.
*Divine Word College of San Jose, Philippines (chontj2015@gmail.com)*
Lazaro, Neofe J.
*Divine Word College of San Jose, Philippines (mharifel.javier.lazaro@gmail.com)*
Limos-Galay, Jenny A.
*Divine Word College of San Jose, Philippines (jennygalay05@gmail.com)*

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***Abstract***

This study aimed to design a framework for the status of spiral progression curriculum mathematics at Divine Word College of San Jose, employing teaching strategies and teaching assessment in the classroom. Using a mixed methods research design, the study showed that the spiral progression curriculum, as assessed by DWCSJ's Grade 10 students, is implemented in terms of retention and continuity of mathematical concepts and higher mathematics readiness. The teaching strategies that are used in the classroom to a very high extent are experiential learning, mastery learning, guided-discovery learning, inquiry-based learning, and individualized learning, and the teaching assessments that are fully implemented in the classroom are in the forms of formative, summative, and self-assessment. The result of the research showed that experiential learning has a significant effect on the retention and continuity of mathematical concepts, and inquiry-based learning has a significant effect on higher mathematics readiness. Summative assessment and self-assessment both significantly affect the retention and continuity of mathematical concepts, and inquiry-based learning significantly affects higher mathematics readiness. With these findings, teachers may emphasize improving other teaching strategies and assessments, particularly formative assessments, which are significant in other literature studies.

***Keywords:*** spiral progression curriculum in mathematics, teaching strategies, teaching assessment, higher mathematics readiness, mathematical concepts

# Teaching strategies, teaching assessment, and spiral progression curriculum in Mathematics in Divine Word College of San Jose

## 1. Introduction

The K–12 basic education system employs a spiral progression curriculum as a framework for delivering the content of each subject. This spiral progression model recognizes that learning is not a linear process but rather a continuous cycle of building upon previously acquired knowledge. Grounded in Jerome Bruner's Spiral Curriculum, which emphasizes revisiting earlier concepts to enhance knowledge organization and application. Moreover, it is essential to note that progression in the curriculum is both vertical and horizontal, enriching learning experiences through revisiting subjects (Corpuz, 2014). The curriculum has been carefully designed to improve the dissemination of content topics and competencies, enhancing clarity and focus for students. And in Mathematics, learners explore five core content areas from kindergarten to grade 10 (K–10), including number sense, measurements, geometry, patterns and algebra, and probability and statistics (Dio, 2020).

The Spiral Progression Curriculum incorporates a range of pedagogical approaches, including constructivist, inquiry-based, reflective, collaborative, and integrative methods (Balagtas et al., 2019). Furthermore, the curriculum adopts a child-centered approach, aligning with Jerome Bruner's view of teachers as translators who tailor knowledge to suit each child's current level of understanding (Clark, 2010; Igcasama, 2021). Further, the Spiral Progression Curriculum makes use of a performance-based assessment to measure and assess learners' performance (Resurrecion & Adanza, 2015). According to DepEd Order No. 8, s. 2015, classroom assessment is viewed as an integral part of curriculum implementation as it shows learners' learning progress and teachers' effectiveness in their instruction. Therefore, classroom assessment in the spiral progression curriculum allows learners to apply the content knowledge to a real-world task. Through topic revisions, the curriculum aims to enhance the retention and mastery of topics and skills, contributing to a more effective learning experience (Quijano and Technical Working Group on Curriculum, 2012). However, the findings of Aranas-Romulo (2015) claimed that learners struggle to relate the previous and present topics, resulting in a lower retention rate. Dio (2020) discovered that if there are breaks between teaching new topics and teaching them again, students may not fully grasp mathematical concepts and skills. Casil et al. (2018) encountered this same problem, suggesting that teachers need to upgrade their strategies and coping mechanisms to meet the demands of the curriculum. It is an important issue to be highlighted because, as Orale and Uy (2018) found out, teachers' qualifications, resources, and training inadequacy are factors affecting favorable outcomes for students. Additionally, Igcasama's (2021) study revealed that teachers still require time, training, and new teaching strategies to engage in in-depth discussions of mathematics content.

Exploring the challenges in the local context of the Spiral Progression Curriculum, the Divine Word College of San Jose also encounters the same challenge, with students struggling to retain previously learned information, particularly in higher education. College students often find it difficult to apply foundational mathematical concepts to more complex problems and real-world situations. Tracing the roots of this issue, the researcher found out that many students were graduates of the same educational institution, thus being considered in the study. As Philippine education persists in seeking methods to provide quality education, the challenge of the Spiral Progression Curriculum's relevance to the Philippine setting becomes noteworthy. However, this paper views teaching strategies and teaching assessments as crucial factors in enhancing the quality of Spiral Progression Curriculum implementation. It seeks to investigate whether teaching strategies and teaching assessment have a direct effect on the spiral progression curriculum. Furthermore, the distinctive commitment of DWCSJ to providing high-quality education renders it a perfect choice for examining the implications of system assessment. The results of this study have the potential to make a valuable contribution not only to the enhancement of the institution but also to the wider discussion on improving the quality and effectiveness of the education system in the Philippines. There is still very little research available on the effectiveness of the spiral progression curriculum as perceived by teaching strategies and teaching assessment in mathematics to provide insight into the possible factors contributing to the issue.

***Statement of the Problem -*** The objective of this study is to investigate the relationship between teaching strategies, teaching assessment and spiral progression curriculum in the context of mathematics education. Specifically, this study attempts to provide answers to the following questions: (1) What are the teaching strategies used in the classroom as identified by the grade 10 students? (2) What are the types of teaching assessment used in the classroom as observed by the grade 10 students? (3) What are the components of spiral progression curriculum described by the grade 10 students? (4) What is the extent of teaching strategies used in the classroom in terms of experiential learning, mastery learning, inquiry-based learning, guided-discovery learning, individualized learning? (5) What is the level of the teaching assessment given in the classroom in terms of formative assessment, summative assessment, self-assessment? (6) What is the status of the spiral progression curriculum in mathematics as observed by grade 10 students in terms of retention and continuity of mathematical concepts, and higher Mathematics Readiness? (7) Is the Spiral Progression Curriculum directly influenced by teaching strategies, and teaching assessment? (8) What framework exists for the integration of teaching strategies and assessment into the Spiral Progression Curriculum?

***Significance of the Study -*** This research aimed to determine the influence of teaching strategies and teaching assessment on the spiral progression curriculum in mathematics in Divine Word College of San Jose. Further, the result of this study may contribute significance to the following: First to the Teachers, this study can aid teachers by acquiring a more profound comprehension of effective teaching strategies and teaching assessment. This knowledge has the potential to enhance their professional growth and facilitate their effectiveness as teachers. Second, to the students, this study can be used as reflection point that a spiral progression can effectively facilitate them in developing a strong foundation and deep understanding of mathematical concepts over time which can be valuable for their academic and future professional success. Third to the curriculum developers, this study has the potential to offer valuable information regarding the impact of the spiral progression curriculum in the field of mathematics. Fourth, to the school administrators, this study can provide insights on how existing teaching strategies and assessments impact the mathematics program, so enabling administrators to make well-informed decisions regarding modifications to the curriculum, teacher training, and other interventions. Lastly, to the future researchers, this study can serve as a fundamental basis for future researchers to conduct more investigations in the domain of mathematics education, hence facilitating the ongoing enhancement of teaching strategies and teaching assessment.

***Scope and Delimitation of the Study -*** The primary objective of this study was to investigate the relationship among teaching strategies, teaching assessment and the status of a spiral progression curriculum in mathematics. The scope of this study was limited to the grade 10 of Divine Word College of San Jose during the school year 2023-2024. They were selected as the participants of the study because they have accumulated substantial mathematical knowledge, enabling deeper engagement with the curriculum and instructional strategies. This study is limited to learners' perception of teaching strategies and teaching assessment in Mathematics to be used as data of this study.

## 2. Methodology

***Research Design -*** This study used a mixed methods research design, specifically using both qualitative and quantitative approaches, in order to address the research questions. The use of a mixed-method design is employed with the intention of offering a more comprehensive understanding of the phenomenon under investigation. Furthermore, the use of mixed-methods would enable researchers to answer research questions with sufficient depth and breadth (Enosh et al., 2014) and help generalized findings and implications of the research issues to the whole population. Consequently, the utilization of a mixed-method approach may serve to capitalize on the respective strengths of each method while mitigating certain drawbacks associated with either approach (Frimer, 2017). Therefore, the aforementioned arguments serve as the rationale for selecting a mixed-method design as the research methodology for this study. This approach was provided a comprehensive investigation into the potential connections between teaching strategies, teaching assessment and the Spiral Progression Curriculum in Mathematics.

***Respondents of the Study -*** A random selection of the fifteen (15) participants from grade 10 students in Divine Word College of San Jose (DWCSJ) was done for the qualitative method. These fifteen (15) participants underwent one-on-one interviews with the researcher and they were not included in the quantitative part. For quantitative method, the respondents of this study were grade 10 junior high school students of DWCSJ. The study involved a complete enumeration of grade 10 students from the Junior High School department. A total of 129 grade 10 were used as sample for this study from 3 sections of grade 10, 31students from St. Arnol Janssen, 49 students from St. Benedict and 49 students form St. Dominic. They were selected as the participants of the study because they have accumulated substantial mathematical knowledge, enabling deeper engagement with the curriculum and instructional strategies.

***Research Instrument -*** An interview guide was used in qualitative phase in order to determine the teaching strategies and assessment used in grade 10 mathematics. The final themes that emerged from the thematic analysis served as basis in identifying the items included in the research questionnaire. This study employed a researcher-made questionnaire to measure the variables, teaching assessment, teaching strategies and the Spiral Progression Curriculum. Further, the use of a researcher-made instrument ensured that the questions were aligned with the study's objectives and context, leading to a more insightful and comprehensive data collection process. Significantly, the items of the questionnaire were translated into the vernacular to ensure the linguistic and cultural appropriateness of the instrument. The assistance of a Filipino Professor was sought to translate and adapt the questions. The researcher sought assistance from experts of Divine Word College of San Jose to establish the validity of the instruments used in this research study. In particular, expert validity was used to validate the research instrument. And through consultation with experts in the field, the researcher was able to obtain valuable insights and expert opinions on the validity of these instruments, strengthening the overall credibility of the research findings. The questionnaire was tried out using the test-retest method. The first try-out was administered to thirty-four (34) student-respondents, then after a week's interval, the retest of the same questionnaire was given to the same group of student-respondents. The questionnaire was comprised of three sections, namely: teaching strategies, teaching assessment, and practices in retaining and ensuring continuity of mathematical concepts and building readiness for higher mathematics. Using the Cronbach's Alpha measure to test the consistency, a generally acceptable result came out which is presented on Table 1.

**Table 1**

*Reliability Results of the Instruments*

| Components | Number of items | Reliability Coefficient* | Interpretation |
|---|---|---|---|
| Teaching Strategies | | | |
| Experiential Learning | 6 | 0.682 | Moderate Reliability |
| Mastery Learning | 6 | 0.740 | High Reliability |
| Inquiry-based Learning | 6 | 0.813 | High Reliability |
| Guided Discovery Learning | 6 | 0.759 | High Reliability |
| Individualized Learning | 6 | 0.766 | High Reliability |
| Teaching Assessment | | | |
| Formative Assessment | 7 | 0.745 | High Reliability |
| Summative Assessment | 7 | 0.661 | Moderate Reliability |
| Self-Assessment | 7 | 0.805 | High Reliability |

| | | | |
|---|---|---|---|
| Spiral Progression Curriculum | | | |
| Retention and Continuity of Mathematical Concepts | 16 | 0.849 | High Reliability |
| Higher Mathematics Readiness | 16 | 0.913 | Very High Reliability |

*Cronbach's Alpha based on standardized items

The computed coefficients denoted a generally high reliability of the instrument. The questionnaire can then be administered to the final group of student-respondents.

***Data Gathering Procedure -*** The researcher sought permission from the school principal of the selected school to conduct a study using Grade 10 junior high school students as participants. Then a random selection of the fifteen (15) participants was done for the qualitative measure, they underwent one-on-one interviews with the researcher. Answers from the interview were qualitative data on the respondent's perception of teaching strategies, teaching assessment, and spiral progression curriculum in mathematics. The qualitative responses were carefully recorded and then thematically analyzed. The use of qualitative data analysis methodology facilitated the identification of recurrent themes and patterns pertaining to the participants' perspectives on teaching strategies, teaching assessment, and spiral progression curriculum in mathematics that became the basis of research questionnaires that were employed in quantitative analysis. The quantitative part of the study involved one hundred twenty-nine (129) grade 10 junior high school students as respondents. The researcher then distributed the questionnaires to the respondents and encoded the gathered data accordingly.

***Statistical Treatment of the Data -*** This study employed a mixed methods research design to investigate the relationships among the variables subjected to this study. To answer the qualitative research question, thematic analysis was used. The SPSS version 26 generated the descriptive statistics using the weighted mean for describing teaching strategies and teaching assessment. The quantitative data analysis to answer the hypothesis was done through the use of the Partial Least Squares-Structural Equation Modeling (PLS-SEM).

***Ethical Considerations -*** This study adhered to the ten ethical considerations outlined by Bryman and Bell (2007). To begin with, the respondents did not experience any form of injury. Second, the decorum of the participants was given top priority. Third, respondents provided informed consent prior to the commencement of the study. Fourth, respondents have the right to withdraw their participation from the study at any point if they want to do so. Furthermore, measures were taken to safeguard the privacy of the research participants, maintain sufficient confidentiality of the research data, and ensure the anonymity of all individuals involved. Finally, all research-related communications were conducted in an honest and transparent manner, ensuring that no misleading information was disseminated and that unbiased presentations of primary data findings were used.

## 3. Results and Discussions

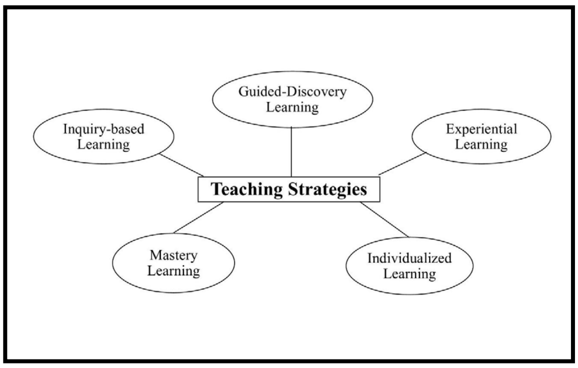


**Figure 1.** Teaching Strategies Final Thematic Map

The final thematic map serves as a summary of the analysis and provides a clear visual representation of the overarching teaching strategies that can guide future instructional decisions. From the analysis made, the emergence of five (5) teaching strategies were concluded: (1) experiential learning, (2) mastery learning, (3) inquiry-based learning, (4) guided discovery learning, and (5) individualized learning. This aligns with the suggested teaching strategies as suggested in the framework of mathematics education in the Philippines. The framework emphasized that mathematics education must be grounded in the theories of experiential and situated learning, discovery and inquiry-based learning, reflective learning, constructivism, and cooperative learning (K–12 Mathematics Curriculum Guide, August 2016). However, constructivism, cooperative learning, and reflective learning take the form of indicators of these emerging teaching strategies.

Overall, the participants emphasized the importance of a supportive teacher who is able to adapt to different learning styles and provide clear explanations. Additionally, they highlighted the significance of a positive and inclusive classroom environment that encourages active participation and fosters a genuine interest in the subject. As a result, students feel supported and motivated to learn, leading to individualized learning and a positive overall learning experience. Thus, this creates a dynamic and enriching classroom environment that promotes growth and success for all students. This transformative experience allowed the students to not only gain knowledge but also develop critical thinking skills and problem-solving abilities. In conclusion, the mathematics classroom at Divine Word College of San Jose reflects a dedication to adhering to the Philippine mathematics education framework by integrating experiential, guided-discovery, inquiry-based, and mastery learning strategies. The synthesis emphasizes the need to establish an inclusive and supportive learning environment that fosters individualized learning, in line with the overall objectives of the educational framework. All these themes were included in the quantitative items of the instrument. The instrument used to measure the extent of the teaching strategies use in the mathematics classroom.

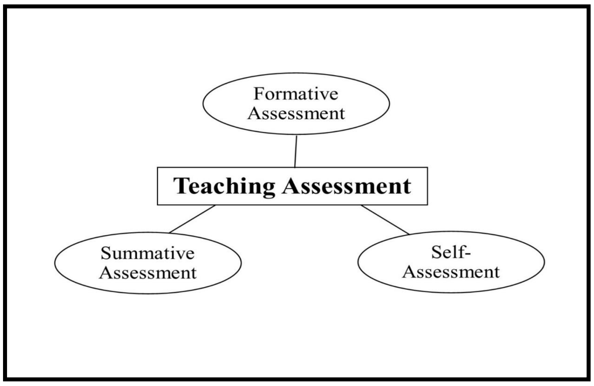


**Figure 2.** Teaching Assessment Final Thematic Map

The analysis that described the teaching assessment was the source of the three final themes that are shown in Figure 2. These themes developed from the interview results. These include formative assessment, summative assessment, and self-assessment. These three themes reflect the different ways in which teachers assess student learning throughout the mathematics classroom. The themes that emerged are in accordance with the suggested assessment in DepEd Order No. 8 Series of 2015. The Order distinguishes between summative and formative assessment and offers multiple viewpoints on each of them. According to the UNESCO Program on Teaching and Learning for a Sustainable Future (UNESCO-TLSF, 2002), formative assessment refers to continuous assessment techniques that are closely associated with the learning process, thus it focuses on providing ongoing feedback and support to students throughout their learning journey and allowing for continuous improvement. Summative assessment as described in the order, is a type of assessment that typically occurs at the end of a learning period to determine the learner's level of achievement, on the other hand, it takes place at the end of a learning period and evaluates the overall understanding and mastery of the subject. Finally, self-assessment empowers students to reflect on their own learning and take ownership of their progress. Together, these themes create a comprehensive and well-rounded approach to assessment that meets the diverse needs of every learner.

Therefore, three themes encompass the various methods and approaches that can be utilized in the assessment process.

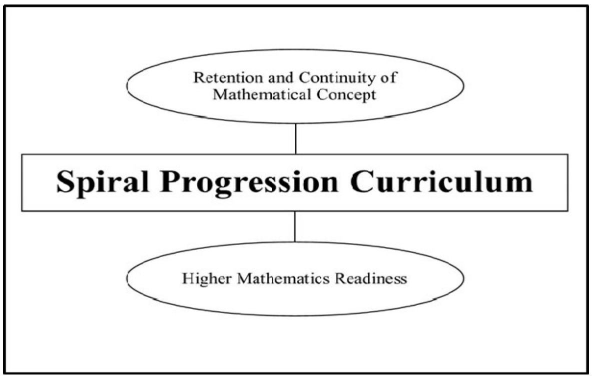


**Figure 3.** Spiral Progression Curriculum Final Thematic Map

The analysis of the final thematic map in Figure 3 shows a clear focus on how retention and continuity of mathematical concepts are shown in the classroom. The indicators of this are revisiting the topics, familiarity of the topics, alignment with everyday activities, interdisciplinary connections, expansion of understanding, complexity of repeated topics, and retention of mathematical concepts. As Dio (2020) explained, the significance of the spiral progression curriculum is that it provides ongoing reinforcement and learning activities that are structured from a basic to an advanced level, enhancing skills to achieve higher-level goals and allowing for the application of acquired knowledge in a flexible learning environment. Further, Corpuz (2014) also highlights that the spiral progression curriculum is designed not just vertically but horizontally in nature. It is to ensure that concepts and skills are gradually increasing in complexity and sophistication. Thus, learning is enhanced, strengthened, and expanded with each instance of revisiting a subject. This is consistent with the second theme, which is higher mathematics readiness. This is characterized by the participants in the form of critical thinking, problem-solving skills, an easier understanding of higher mathematics, the development of mental skills, and the application of topics. This aligns well with the goal of preparing students for higher mathematics by fostering critical thinking, problem-solving abilities, and a stronger grasp of complex topics. Therefore, it can be inferred that the process of revisiting subjects leads to an increase in sophistication, ultimately contributing to higher mathematics readiness. By continuously engaging with topics, students not only enhance their learning but also develop the necessary skills.

Table 2 shows the mean extent of the teaching strategies used in the classroom. It can be inferred that the teachers in the classroom consistently implement teaching strategies such as experiential learning (4.51), mastery learning (4.54), inquiry-based learning (4.51), guided discovery learning (4.53), and individualized learning (4.57). These strategies are used to a very high extent, as indicated by the high weighted means for each indicator. The overall mean of 4.53 also suggests that these strategies are used to the very high extent. The teaching strategies used by teachers in the context of experiential learning is significantly high. This means that teachers frequently use both individual and group activities, as well as a variety of learning resources, to promote experiential learning in mathematics. . The findings suggest that incorporating real-life tasks, visual and written instructional tools, and practical activities can greatly contribute to a comprehensive and immersive learning experience in mathematics. As a result, it can be inferred that students who engage in real-life tasks, utilize visual and written instructional tools, as well as participate in practical activities, will experience a very high extent of learning in mathematics. In a study conducted by Venkatraman et al. (2019), they noted that experiential learning, visual exercises, and 'Mathematician Stories' were interesting for students. The students actively participated in class, demonstrating engagement in exercises such as proving triangles using visual methods. Tong et al. (2019) applied experiential learning to enhance students' understanding of the equation of the circle and found it to positively influence students' attitudes, engagement, learning results, and development of foundational skills and competences. This also holds true for primary school mathematics, in which Sun and Xiao (2023) assert that experiential learning in mathematics improves fundamental mathematical skills. The research indicates that practical learning might enhance students' fundamental mathematical abilities, such as numeracy, spatial thinking, and problem-solving capabilities. Experiential learning involves students participating in practical activities and self-reflection to gain new mathematical knowledge, abilities, and attitudes that build upon their current understanding and experiences.

**Table 2**

*Mean Extent of Teaching Strategies Used by the Teachers in Terms of Experiential Learning, Mastery learning, Inquiry-based learning, Guided-discovery learning and Individualized learning*

| Indicators (Experiential Learning) The teacher… | Weighted Mean | Verbal Description |
|---|---|---|
| 1. gives group and individual activities. | 4.36 | High Extent |
| 2. uses a variety of learning materials such as textbook, worksheets and lecture notes. | 4.43 | High Extent |
| 3. encourages students to apply what they have learned in real-life situations. | 4.51 | Very High Extent |
| 4. uses visual and written instructional tools, such as PowerPoint and blackboards. | 4.72 | Very High Extent |
| 5. gives additional examples during discussion to reinforce learning. | 4.58 | Very High Extent |
| 6. uses lessons from the past to help learn new things. | 4.45 | High Extent |
| Composite Mean | 4.51 | Very High Extent |
| Indicators (Mastery Learning) The teacher… | | |
| 1. revisits formulas during class discussions. | 4.48 | High Extent |
| 2. employs mnemonic devices or memory aids to help remember the lessons. | 4.23 | High Extent |
| 3. gives formulas to help in solving questions about the lesson while they are being taught. | 4.65 | Very High Extent |
| 4. the importance of ensuring comprehensive understanding of the material before moving on to the next topic. | 4.63 | Very High Extent |
| 5. of providing additional examples during activities to reinforce learning. | 4.62 | Very High Extent |
| 6. provides a structured introduction and explanation of the lessons. | 4.61 | Very High Extent |
| Composite Mean | 4.54 | Very High Extent |
| Indicators (Inquiry-Based Learning) The teacher… | | |
| 1. asks questions related to the lesson before, during and after the lesson proper. | 4.50 | Very High Extent |
| 2. encourages students to ask questions about what they do not understand during discussion. | 4.62 | Very High Extent |
| 3. encourages students to ask questions to start the interaction of the class. | 4.47 | High Extent |
| 4. encourages students to apply what they have learned. | 4.48 | High Extent |
| 5. inquiries about what students know about the lesson. | 4.51 | Very High Extent |
| 6. practices seeking student thoughts and ideas before giving solutions. | 4.50 | Very High Extent |
| Composite Mean | 4.51 | Very High Extent |
| Indicators (Guided-Discovery Learning) The teacher… | | |
| 1. starts with easy ideas and build up to more complex ones over time, ensuring a step-by-step understanding of the lesson. | 4.60 | Very High Extent |
| 2. accepts any answer as long as it reflects what students have learned. | 4.50 | Very High Extent |
| 3. explains concepts that students find difficult. | 4.58 | Very High Extent |
| 4. introduces vocabulary and concepts as a foundational step to learning the lesson. | 4.52 | Very High Extent |
| 5. practices seeking student opinions and involvement before presenting solutions. | 4.47 | High Extent |
| 6. gives immediate clarification through additional examples. | 4.53 | Very High Extent |
| Composite Mean | 4.53 | Very High Extent |

| | | |
|---|---|---|
| Indicators (Individualized Learning) The teacher… | | |
| 1. asks students to complete the activities individually. | 4.57 | Very High Extent |
| 2. changes the speed of the lesson for students who may be having trouble keeping up. | 4.51 | Very High Extent |
| 3. provides support for students who struggle to understand the lesson. | 4.56 | Very High Extent |
| 4. places a strong emphasis on explaining concepts comprehensively. | 4.57 | Very High Extent |
| 5. makes math learning engaging. | 4.63 | Very High Extent |
| 6. encourages students to asks questions every meeting. | 4.59 | Very High Extent |
| Composite Mean | 4.57 | Very High Extent |
| Overall Mean | 4.53 | Very High Extent |

**Scale**: 4.50-5.00 -Very High Extent; 3.50-4.49 –High Extent; 2.50-3.49 –Moderate Extent;1.50-2.49 –Least Extent; 1.00-1.49 –No Extent

Moreover, in terms of teaching strategies used by teachers with a focus on mastery learning reveals high and very high extent of implementation across various indicators. This means that giving formula during discussion, emphasizing the importance of ensuring comprehensive understanding of the lesson, giving additional examples during activities, and providing a structured introduction to the new lesson are all practices that are very highly observed in the classroom. The composite mean, calculated by considering all indicators together, is 4.54, indicating an overall very high extent of implementation of teaching strategies emphasizing mastery learning. These strategies foster the development of an efficient learning environment where students are actively involved and motivated to attain mastery in their studies. The high composite mean indicates that the teaching strategies employed in the classroom are effective in developing a comprehensive understanding and facilitating student learning. This aligns with the result that students taught using mastery learning tend to assimilate taught concepts more easily, leading to enhanced academic achievement (Oginni et al., 2021). Further, Vlădescu (2023) found out that mastery learning can improve mathematics achievement in the classroom. Particularly, teacher-student interaction, guided instruction, and monitoring of student activities were identified as crucial aspects that impact academic results. The study highlighted the significance of supplemental activities following the mastery learning approach in improving student outcomes.

In terms of teaching strategies with a focus on inquiry-based learning, the analysis indicates a continuously high and very high extent of application across many indicators. This implies that practices such as asking questions before, during and after the lesson, asking what the students do not understand during discussion, inquiring what the students know about the lesson and seeking students’ thoughts before giving solutions to problems are frequently used instructional strategies related to inquiry-based learning. All the indicators were averaged to get the composite mean, which is 4.51. This means that there is a very high extent of implementation of teaching strategies that focus on inquiry-based learning in schools. This implies that inquiry-based learning is being effectively implemented in the classroom, allowing students to engage in critical thinking and problem-solving skills. Similar results were found by Khasawneh et al. (2023), in which students who received the inquiry-based learning treatment excelled in constructing knowledge, explaining, reasoning, questioning, and interacting with their instructor and peers. Şen et al. (2021) also stated that in an inquiry-based classroom, students' prediction, explanation, generalization, and justification skills were identified as measures of reasoning ability. Students utilized their previous knowledge to make various predictions and generalizations, and they devised solutions to challenges using diverse strategies. And finally, when applied to enhancing basic competencies in calculus, inquiry-based learning positively enhanced students' mastery of the topic limits and continuity (Santos & Boyon, 2020).

Furthermore, the findings demonstrate a consistently very high extent of adoption across multiple indicators except for indicator 5 as employed by teachers with a specific emphasis on guided discovery learning. This implies that the teacher widely used strategies such as starting with simple ideas, gradually increasing complexity, providing a step-by-step understanding, accepting answers that reflect learning, explaining difficult concepts, introducing vocabulary and concepts as foundations, and providing immediate clarification through additional examples in the classroom. By providing students with opportunities to apply their knowledge in practical ways, they are able to develop a deeper understanding of the concepts being taught. This strategy not only enhances student engagement but also promotes critical thinking and problem-solving skills. This is coherent with the findings of Amiyani & Widjajanti (2018), in which the use of guided discovery learning enhances mathematics learning achievement, cognitive ability, conceptual understanding, and mathematical reasoning. Guided discovery learning has been linked to improving critical and creative thinking skills. Students have responded positively to learning activities and components in guided discovery models, showing a deeper comprehension of mathematical topics. Furthermore, Samron and Arua (2021) disclosed that implementing mathematics learning using the guided discovery model entails students making observations, inquiries, and conclusions to uncover concepts, resulting in a deeper understanding through a cognitive process. The guided discovery learning paradigm highlights the importance of active student engagement, idea exploration activities, and problem-solving to enhance students' critical thinking skills in mathematics.

Under the guided discovery learning approach, engaging in group discoveries and student-centered activities can increase students' motivation to learn mathematics. Students who are taught using the guided discovery paradigm possess a more extensive understanding of mathematical ideas. Lastly, the data reveals a consistently very high extent of implementation across various indicators with a specific emphasis on individualized learning. The composite mean, which highlights a very high extent of implementation of teaching strategies emphasizing individualized learning, is 4.57. These teaching strategies have proven to be highly effective in ensuring that each student receives the necessary support and attention they need to succeed. By allowing students to work at their own pace and providing additional assistance when needed, struggling learners are given the opportunity to catch up and fully understand the concepts being taught. The comprehensive explanations and engaging activities further enhance their understanding and make math learning enjoyable for all students. The high weighted means and composite mean indicate that these strategies are consistently implemented in the classroom, leading to positive outcomes in student learning. In alignment with this, a study conducted by Ubas et al. (2019) found that individualized learning in the form of a tutorial program has a promising effect on the lives of Badjao children. They appreciate the activities given to them by their teachers, minimize the discrimination they feel in the classroom, lessen their shyness, and actively participate in class. Thus, concluding that Badjao students could succeed in mathematics with the help of individualized learning.

**Table 3**

*Mean Level of Teaching Assessment Given by the Teachers in Terms of Formative Assessment, Summative Assessment and Self-assessment*

| Indicators (Formative Assessment) The teacher… | Weighted Mean | Verbal Description |
|---|---|---|
| 1. asks questions to check for immediate understanding during lessons. | 4.60 | Fully Implemented |
| 2. provides immediate feedback to correct misconceptions. | 4.55 | Fully Implemented |
| 3. emphasizes the connection between new and previous topics. | 4.50 | Fully Implemented |
| 4. provides immediate one-on-one assistance with new examples to ensure students' comprehension. | 4.42 | Mostly Implemented |
| 5. gives individual or group activities to ensure mastery of the lesson. | 4.53 | Fully Implemented |
| 6. gives rewards or positive reinforcement to motivate students. | 4.54 | Fully Implemented |
| 7. asks students to give examples and explanations, promoting a deeper understanding of the lesson. | 4.46 | Mostly Implemented |
| Composite Mean | 4.52 | Fully Implemented |
| Indicators (Summative Assessment) The teacher… | | |
| 1. gives quizzes at the end of the topic. | 4.38 | Mostly Implemented |
| 2. provides problem-solving activities as a means of assessing student comprehension after completing a series of lessons. | 4.66 | Fully Implemented |

| | | |
|---|---|---|
| 3. uses different question formats in summative quizzes. | 4.50 | Fully Implemented |
| 4. incorporates technology, such as tablet and calculators, to help students answer the quizzes. | 4.50 | Fully Implemented |
| 5. aligns quizzes with the learning objectives and content. | 4.56 | Fully Implemented |
| 6. provides different types of assessment activities, such as performance tasks and written works. | 4.60 | Fully Implemented |
| 7. returns corrected quizzes or activities. | 4.62 | Fully Implemented |
| Composite Mean | 4.54 | Fully Implemented |
| Indicators (Self-Assessment) The teacher… | | |
| 1. encourages self-assessment by having students create educational videos. | 4.36 | Mostly Implemented |
| 2. inquires about what students know about the lesson. | 4.47 | Mostly Implemented |
| 3. provides opportunities for students to reflect on their understanding through activities after each lesson. | 4.51 | Fully Implemented |
| 4. provides feedback and motivation to students. | 4.55 | Fully Implemented |
| 5. seeks voluntary participation in class. | 4.53 | Fully Implemented |
| 6. encourages students to ask questions during the discussion. | 4.53 | Fully Implemented |
| 7. allows students to choose assessment activities that match their skills and interests. | 4.53 | Fully Implemented |
| Composite Mean | 4.50 | Fully Implemented |
| Overall Mean | 4.52 | Fully Implemented |

**Scale**: 4.50-5.00 –Fully Implemented; 3.50-4.49 –Mostly Implemented;2.50-3.49 –Partially Implemented; 1.50-2.49 –Minimally Implemented; 1.00-1.49 –Not Implemented

Table 3 shows the mean level of teaching evaluation that the teacher provided with regard to formative assessment, summative assessment and self-assessment. The consistent high scores and uniform classification highlight the use of formative assessment procedures in the classroom. The weighted mean of 4.52 indicates as fully implemented, it can be inferred that the formative assessment procedures used in the classroom have been effective. Immediate feedback and promoting deeper understanding during lessons have likely contributed to this success. Additionally, activities for mastery, one-on-one assistance, and positive reinforcement have helped motivate students and promote their learning. Similar findings were found by Kamarudin et al. (2021), in which teachers in Oman used several assessment practices to assess students' mathematical thinking, with formative assessment practices being used more than other assessment practices. Kültür & Kutlu (2021) revealed in their study that students claimed that the implementation of formative assessment practices aided in the clarification of course material, learning outcomes, and criteria for success, resulting in a beneficial impact on their learning experience. Moreover, they indicated that the implementation of formative assessment techniques aided their comprehension of subjects and enabled students to identify erroneous or incomplete aspects of their learning process, therefore enhancing their overall learning experience. The composite mean obtained by summative assessment is 4.54, which is also interpreted as fully implemented. That is, the use of problem-solving activities allows students to apply their knowledge in real-world scenarios, while the incorporation of technology provides additional resources for student support.

Additionally, aligning quizzes with learning objectives ensures that students are being assessed on the concepts they have learned, and returning corrected quizzes or activities allows for valuable feedback and reflection. This discovery is relevant to the findings of the study, which show a direct relationship between students' logical reasoning abilities and their academic performance in mathematics (Chytry & Kubiatko, 2021). They highlighted that students who excel in mathematics tend to exhibit advanced logical reasoning skills, suggesting a significant correlation between mathematical aptitude and the results of summative assessments. Students who perform well academically in mathematics also demonstrate superior mathematical abilities. In addition, according to Kamarudin et al. (2021), teachers in Oman used tools like homework, class projects, and student presentations as part of summative assessment methods to evaluate students' mathematical reasoning. The least common summative assessment was evaluating the mathematical reasoning skills of each student at the conclusion of the mathematics course.

The composite mean 4.50 in terms of self-assessment, acts as a comprehensive indicator, indicating a general state of being fully implemented for self-assessment. In addition, the classroom setting fosters active involvement and interaction, with students being encouraged to inquire and express their viewpoints. This facilitates a more dynamic and engaging learning experience. Moreover, employing a range of assessment activities accommodates the varied skills and interests of the students, ensuring that they can demonstrate their capabilities through various means. In general, although there is still potential for enhancing the integration of educational videos into self-assessment, the classroom as a whole is considered to have successfully integrated practices that promote students' self-assessment in the classroom. Similar findings were found by Barana et al. (2022), who emphasized varied strategies for integrating self-assessment in a mathematics classroom. These strategies involve establishing clear assessment criteria, utilizing rubrics, promoting reflection on problem-solving, incorporating peer assessment for feedback, providing constructive feedback, scaffolding practice from simple to complex tasks, and integrating digital tools like Advanced Computing Environments (ACE) to enhance self-assessment accuracy and skill development.

Table 4 shows the mean status of the spiral progression curriculum in terms of retention and continuity of mathematical concepts. The indicators are the different teaching strategies and assessment methods employed in the classroom. The composite mean of all the indicators is 4.57, which suggests a significant level of effectiveness in promoting the retention and continuity of mathematical concepts within the spiral progression curriculum. Therefore, incorporating formulas during math lessons has proven to be successful in helping students remember and develop their understanding of mathematical concepts. While, the result of individual and collaborative activities was seen as highly effective, however, it still requires improvements on how it is carried out. Furthermore, it would be advantageous to investigate if there were any specific factors or variables that influenced the effectiveness of individual and collaborative activities in maintaining and reinforcing mathematical concepts. This suggests that by identifying these factors, educators can tailor their teaching strategies to optimize student learning and retention.

**Table 4**

*Mean Status of Spiral Progression Curriculum in Terms of Retention and Continuity of Mathematical Concepts and Higher Mathematics Readiness*

| Indicators<br>The teacher... | Weighted Mean | Verbal Description |
|---|---|---|
| 1. gives group and individual activities. | 4.50 | Very Highly Effective |
| 2. gives additional examples during discussion to reinforce learning. | 4.64 | Very Highly Effective |
| 3. revisits formulas during class discussions. | 4.56 | Very Highly Effective |
| 4. emphasizes the importance of ensuring comprehensive understanding of the material before moving on to the next topic. | 4.64 | Very Highly Effective |
| 5. asks questions about the lesson before, during and after the lesson proper. | 4.56 | Very Highly Effective |
| 6. inquires about what students know about the lesson. | 4.56 | Very Highly Effective |
| 7. starts with easy ideas and build up to more complex ones over time, ensuring a step-by-step understanding of the lesson. | 4.57 | Very Highly Effective |
| 8. introduces vocabulary and concepts as a foundational step to learning the lesson. | 4.57 | Very Highly Effective |
| 9. changes the speed of the lesson for students who may be having trouble keeping up. | 4.55 | Very Highly Effective |

| | | |
|---|---|---|
| 10. provides support for students who struggle to understand the lesson. | 4.60 | Very Highly Effective |
| 11. asks questions to check for immediate understanding during lessons. | 4.57 | Very Highly Effective |
| 12. provides immediate feedback to correct misconceptions. | 4.53 | Very Highly Effective |
| 13. gives quizzes at the end of the topic. | 4.53 | Very Highly Effective |
| 14. uses different question formats in summative quizzes. | 4.56 | Very Highly Effective |
| 15. provides opportunities for students to reflect on their understanding through activities after each lesson. | 4.55 | Very Highly Effective |
| 16. encourages students to ask questions during the discussion. | 4.59 | Very Highly Effective |
| Composite Mean | 4.57 | Very Highly Effective |

**Scale:**4.50-5.00 -Very Highly Effective; 3.50-4.49 –Highly Effective;2.50-3.49 –Moderately Effective; 1.50-2.49 –Least Effective; 1.00-1.49 –Not Effective

These findings are consistent with Enikanolaye (2021), who concluded that there was a difference in the retention level of students exposed to multimedia instructional strategies compared to those not exposed to them. The retention level was higher for students exposed to multimedia instructional strategies, indicating that multimedia instruction leads to more permanent and meaningful learning. Further, the use of mastery learning strategies such as logical presentation of material and giving feedback has a significant effect on retention in mathematics, as Ihendinihu (2020) revealed in his study. In another study, retention and conceptual understanding of eight-graders in linear equations and slope were found to be significantly improved when ICT-based instructional material is used (Birgin & Uzun Yazcı, 2021). Additionally, Penazzi (2015) found that regular formative assignments and activities assist students in structuring their studies, fostering motivation, and enabling self-assessment of their progress, ultimately resulting in improved retention. Further, summative assessments, when used alongside formative assessments, can help identify misconceptions of basic information and enable instructors to create targeted teaching strategies to improve understanding of concepts.

Table 5 presents the result of the mean status of the spiral progression curriculum concerning higher mathematics readiness. The indicators represent the instructional strategies and assessment procedures that contribute to students' preparedness for higher-level mathematics. The composite mean, which denotes the average value encompassing all indicators, is 4.58, reinforcing the pattern observed in each individual indicator. The high composite mean emphasizes the effectiveness of teaching strategies and assessment in promoting readiness for advanced mathematics. The high mean scores of using different learning materials, reviewing formulas during lessons, and providing assistance to struggling students have contributed significantly to preparing them for advanced mathematical topics. On the other hand, while all indicators are considered highly effective, the varying ratings suggest subtle differences in the functionality of different teaching strategies and evaluation methods used.

**Table 5**

*Mean Status of Spiral Progression Curriculum in Terms of Retention and Continuity of Mathematical Concepts and Higher Mathematics Readiness*

| Indicators<br>The teacher... | Weighted<br>Mean | Verbal Description |
|---|---|---|
| 1. gives group and individual activities. | 4.56 | Very Highly Effective |
| 2. gives additional examples during discussion to reinforce learning. | 4.60 | Very Highly Effective |
| 3. revisits formulas during class discussions. | 4.52 | Very Highly Effective |
| 4. emphasizes the importance of ensuring comprehensive understanding of the material before moving on to the next topic. | 4.64 | Very Highly Effective |
| 5. asks questions about the lesson before, during and after the lesson proper. | 4.58 | Very Highly Effective |

| | | |
|---|---|---|
| 6. inquires about what students know about the lesson. | 4.56 | Very Highly Effective |
| 7. starts with easy ideas and build up to more complex ones over time, ensuring a step-by-step understanding of the lesson. | 4.57 | Very Highly Effective |
| 8. introduces vocabulary and concepts as a foundational step to learning the lesson. | 4.57 | Very Highly Effective |
| 9. changes the speed of the lesson for students who may be having trouble keeping up. | 4.57 | Very Highly Effective |
| 10. provides support for students who struggle to understand the lesson. | 4.64 | Very Highly Effective |
| 11. asks questions to check for immediate understanding during lessons. | 4.69 | Very Highly Effective |
| 12. provides immediate feedback to correct misconceptions. | 4.59 | Very Highly Effective |
| 13. gives quizzes at the end of the topic. | 4.51 | Very Highly Effective |
| 14. uses different question formats in summative quizzes. | 4.56 | Very Highly Effective |
| 15. provides opportunities for students to reflect on their understanding through activities after each lesson. | 4.55 | Very Highly Effective |
| 16. encourages students to ask questions during the discussion. | 4.60 | Very Highly Effective |
| Composite Mean | 4.58 | Very Highly Effective |

**Scale:**4.50-5.00 -Very Highly Effective; 3.50-4.49 –Highly Effective;2.50-3.49 –Moderately Effective; 1.50-2.49 –Least Effective; 1.00-1.49 –Not Effective

This finding implies that teachers who employ these teaching strategies and assessments are more proficient in equipping students for advanced mathematics. Moreover, it underscores the significance of integrating these strategies into curriculum design to ensures students' achievement in advanced mathematics. In their 2023 study, Abalde and Oco (2023) concluded that students believe that learning mathematics is essential in order for them to become successful and achieve academic advancement. Thus, it is important that they have a full understanding of mathematical concepts. Penazzi (2015) indicates that formative assessments are useful for giving feedback and teaching study methods, but they may not completely support the growth of mathematical reasoning or encourage students to engage in advanced mathematical problems. Hence, the use of summative assessment is highlighted. In addition, Simamora et al. (2018) explored the effectiveness of guided discovery learning in mathematics. The study findings indicate that guided discovery learning could improve students' readiness for advanced mathematics through developing a profound comprehension of mathematical concepts, encouraging active participation in learning, and boosting students' confidence in their mathematical skills.

**Table 6**

*Path Coefficients and p-values for Ho*

| Paths | Beta (β) Coefficients | p-values* | Interpretation |
|---|---|---|---|
| TS-Experiential Learning→RCT | 0.184 | 0.016 | Significant |
| TS-Mastery Learning→RCT | 0.129 | 0.067 | Not Significant |
| TS-Inquiry-based Learning→RCT | -0.049 | 0.288 | Not Significant |
| TS-Guided-Discovery Learning→RCT | 0.107 | 0.107 | Not Significant |
| TS-Individualized Learning→RCT | 0.070 | 0.210 | Not Significant |
| TS-Experiential Learning→HMR | 0.107 | 0.108 | Not Significant |
| TS-Mastery Learning→HMR | 0.111 | 0.099 | Not Significant |
| TS-Inquiry-based Learning→HMR | 0.172 | 0.022 | Significant |
| TS-Guided-Discovery Learning→HMR | 0.120 | 0.082 | Not Significant |
| TS-Individualized Learning→HMR | 0.055 | 0.265 | Not Significant |

| | | | |
|---|---|---|---|
| Formative Assessment→RCT | 0.141 | 0.051 | Not Significant |
| Summative Assessment→RCT | 0.250 | 0.002 | Significant |
| Self-Assessment→RCT | 0.204 | 0.008 | Significant |
| Formative Assessment→HMR | 0.132 | 0.063 | Not Significant |
| Summative Assessment→HMR | 0.181 | 0.017 | Significant |

*Significant at p<0.05

The results of the structural equation analysis in Table 6 show that the teaching strategies of experiential learning (β=0.184, p=0.016) and inquiry-based learning (β=0.172, p=0.022) have a direct effect on the spiral progression curriculum, taking into account higher mathematics readiness and retention of mathematical concepts, respectively. Teaching assessment in the form of summative (β=0.250, p=0.002) and self-assessment (β=0.204, p=0.008) shows significant influence on the retention and continuity of mathematical concepts. Thus, summative assessment (=0.181, p = 0.017) and self-assessment (=0.339, p = 0.001) significantly influence higher mathematics readiness. Following the analysis, suggests rejection of the hypothesis that the Spiral Progression Curriculum is not directly influenced by teaching strategies through experiential learning and inquiry-based learning and teaching assessment in the form of summative and self-assessment. The p-values less than 0.05 support the statement, which means that exogenous variables posed a significant influence on the endogenous variable. It can be stated that teaching strategies through experiential learning and inquiry-based learning and teaching assessment in the form of summative and self-assessment directly influence the status of the spiral progression curriculum. For instance, Mutmainah et al., (2019) after conducting a study on teaching material in mathematics, it was discovered that utilizing experiential learning-based teaching material was successful in enhancing the cognitive ability of fifth-grade students. The group that was exposed to this type of teaching material achieved a higher average score on the posttest compared to the control group, which utilized conventional teaching material. The focus of cognitive ability in this context pertains to the students' ability to understand mathematical concepts, utilize mathematical algorithms, and solve mathematical problems.

Additionally, research by Gómez-Chacón et al. (2023) delved into the effects of inquiry-based mathematics education on students' attitudes toward mathematics. The results indicate that the instructional experience focusing on the nature of mathematical inquiry led to positive developments in students' perceived usefulness of mathematics and mathematical self-concept. The perceived usefulness of mathematics is associated with higher math readiness in such a way that students who view mathematics as useful are more likely to engage in higher-level thinking and problem-solving. The findings suggest that through practice, reflection, questioning, and engaging with concrete examples of mathematical practices like conjecturing, proving, and communicating, students' attitudes towards the usefulness of mathematics improved. This, in turn, can lead to higher mathematical readiness. This finding aligns with Mehmood et al. (2019), who found that students taught with the inquiry-based method showed better outcomes in terms of learning and understanding mathematics concepts compared to those taught with traditional methods. Focusing on teaching assessment, findings by Chytry and Kubiatko, (2021) revealed that there is a strong dependence between mathematical thinking and school assessment in mathematics. This highlights the importance of summative assessment in the retention and continuity of mathematical concepts as well as in higher mathematics readiness. The results of their study suggest that summative assessment can help reinforce learning and retention of key mathematical concepts by assessing how well students have internalized and can apply the knowledge acquired, support the progression and development of mathematical skills over time, and provide insights into their preparedness for advanced mathematical topics.

Also, self-assessment plays a crucial role in enhancing mathematical thinking. By encouraging students to reflect on their own understanding and identify areas for improvement, self-assessment promotes a deeper level of engagement with mathematical concepts. As discussed by Barana et. al. (2022), self-assessment played a central role in enabling students to evaluate their own problem-solving abilities across various indicators, such as comprehension of the problematic situation, identification of solving strategies, development of the solving process, argumentation of chosen strategies, and the effective use of advanced computing environments (ACE). The study emphasized the significance of self-assessment in empowering students to evaluate their mathematical problem-solving capabilities, identify areas for improvement, and enhance their overall performance in mathematics.

However, it is important to note that not all teaching strategies and assessments presented on the table are found to have a significant effect on the Spiral Progression Curriculum in terms of retention and continuity of mathematical concepts and higher mathematics readiness. From the table 5, mastery learning, guided-discovery discovery learning, and individualized learning are those strategies that do not have a significant effect on the retention and continuity of mathematical concepts and higher mathematics readiness. These teaching strategies may not be as effective in promoting long-term understanding and application of mathematical concepts. However, they can still be useful for short-term learning and immediate problem-solving. Findings by Ogwari et al. (2020) disclosed that after the use of personalized learning, there is no significant difference between the posttest scores of the control group and the experimental group. Lekan and Emmanuel (2020) also revealed that students instructed with individualized learning strategies had lower retention of mathematical ideas compared to those instructed with collaborative learning strategies. More precisely, pupils who were taught using the individualized learning approach had lower average retention scores in comparison to those who were taught using cooperative learning.

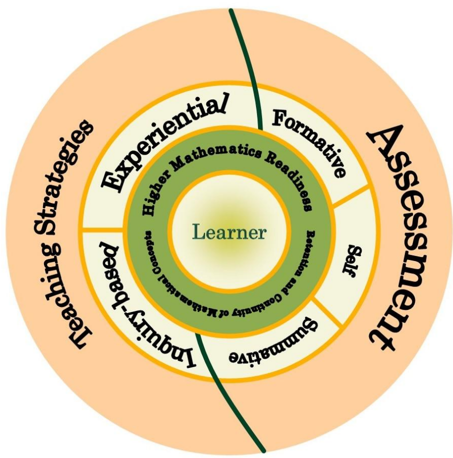


**Figure 4.** Spiral Progression Curriculum Final Thematic Map

The spiral progression curriculum at Divine Word College of San Jose ensures that the learner is continuously exposed to mathematical concepts and skills throughout their education is presented in Figure 4. This approach allows students to build upon their previous knowledge and develop a deeper understanding of mathematics as they progress through the curriculum. Additionally, the focus on higher mathematics readiness prepares students for more advanced mathematical concepts and problem-solving skills in future courses. Strategies and assessments play an integral part in achieving this outcome in mathematics education. Specifically, the use of experiential and inquiry-based learning methods can help learners connect mathematical concepts to real-world situations and engage in hands-on problem-solving. These approaches encourage critical thinking and foster a deeper understanding of mathematical principles. Experiential learning is characterized by active learning, the integration of technology in teaching, and collaborative and individualized learning experiences. Inquiry-based learning operates through an interactive teaching-learning process and an inquisitive classroom. This claim fits with the 5E model of inquiry-based learning as used by Mehmood et al. (2019) in their study. The engagement phase includes motivating students by introducing mathematics challenges that are relevant to real-life situations, encouraging curiosity by presenting difficult topics that require critical thought, and utilizing multimedia materials or interactive methods to engage students in the subject matter. Incorporating practical activities and experiments to explore mathematical concepts, encouraging collaboration among students to explore different problem-solving approaches, and providing opportunities for students to collect data, observe, and analyze patterns are activities in the exploration phase. The explanation phase begins when teachers promote discussions among students to articulate their understanding of mathematical principles, allow them to share their discoveries with classmates, and provide reasoning for their solutions.

Regular formative and summative assessments, together with self-assessment, also provide opportunities for students to demonstrate their understanding and identify areas where they may need additional support or practice. This aligns with the Department of Education Order No. 8 Series of 2015, which discloses the guidelines on classroom assessment for the K–12 basic education program. Formative assessment is done before, during, and after the lesson in the classroom. Revisiting the previous lesson and addressing misconceptions are needed in the classroom before starting the lesson to help teachers assess students' level of conceptual comprehension and practical application before the lesson to adjust instruction as needed. During the lesson, formative assessment is in the form of asking questions, providing feedback, and giving explanatory activities and assistance to students. To check the attainment of the learning outcomes, assessment after the lesson is conducted. These are in the form of ungraded activities that will enrich the students' understanding of the topic. Summative assessment, which is an indicator of the performance of the students, has three components, namely: written works, performance tasks, and quarterly assessments. And self-assessment is integrated between the formative and summative assessments because this is the students' own mechanism to reflect on their own learning. This assessment can be shown through self-reflection journals, the use of rubrics, or peer evaluations. Additional features of assessment in the classroom include the integration of technology in assessment and collaborative, individualized and varied activities. By combining these strategies and assessments, teachers can ensure that learners are actively engaged in the learning process and continuously building upon their mathematical knowledge. The circle in the framework represents the continuous relationship among the variables in the framework.

## 4. Conclusions

Based on the findings, the following conclusions are derived: Experiential learning, mastery learning, inquiry-based learning, guided discovery learning, and individualized learning are the teaching strategies employed by teachers to facilitate student learning in mathematics. Formative, summative, and self-assessments are used by the teacher in assessing the learners' performance in Mathematics. The components of spiral progression curriculum are retention and continuity of mathematical concepts and higher mathematics readiness. Teaching strategies that include experiential learning, mastery learning, inquiry-based learning, guided discovery learning, and individualized learning are employed to a very high extent in class. Formative assessment, summative assessment and self-assessment are fully implemented within the classroom. The spiral progression curriculum in terms of retention and continuity of mathematical concepts and higher mathematics readiness is successfully implemented with a high level of effectiveness. Teaching strategies using experiential learning and inquiry-based learning have significant effect on the spiral progression curriculum specifically for retention and continuity of mathematical concepts and enhancing higher mathematics readiness, respectively. Summative assessment and self-assessment have a moderate and significant effect on the retention and continuity of mathematical concepts and higher mathematics readiness in the spiral progression curriculum. A proposed framework as shown in figure 11 is designed to supplement the status of spiral progression curriculum in mathematics.

### *4.1 Recommendations*

The findings and conclusions of the study lead to the following recommendations: Mathematics teachers may use a variety of teaching strategies in the classroom to meet and address the needs of their students. Students in Grade 7 through 10 may be informed about the benefits of the various assessments in the classroom in order to develop autonomy in their learning journey. Officials from the Department of Education may make sure that policies and funding are in place to support the spiral progression curriculum. Mathematics teachers may emphasize providing experiences in the classroom that are experiential and inquiry-based in nature to positively impact students' retention and continuity of mathematical concepts and higher mathematics readiness. Mathematics teachers may identify areas for improvement in the use of formative assessment in the classroom to have a significant influence in the retention and continuity of mathematical concepts and higher mathematics readiness. Administrators may strengthen support for teachers in continuous professional development to improve their expertise in implementing spiral progression curriculum and their teaching and assessment practices. Administrators and mathematics teachers may conduct a review of spiral progression curriculum coherence in instructional planning and delivery. Divine Word College of San Jose may adopt the designed framework to craft an evaluation mechanism for teachers to ensure that they are meeting the standard in teaching and assessment practices. School heads and mathematics teacher may create a standardized test aligned with the curriculum to assess learners' retention of mathematical concepts. Further investigations may be conducted to explore the variation of other teaching strategies and assessment methods in relation to the implementation of spiral progression curriculum in terms of retention and continuity of mathematical concepts and higher mathematics readiness. More extensive research for other grade levels may be undertaken to determine whether the design framework is equally effective across different age groups.

## 5. References


Abalde, G. D., & Oco, R. M. (2023, April 7). Factors Associated with Mathematics Performance. *Asian Research Journal of Mathematics*, 19(6), 45–60. https://doi.org /10.9734/ arjom/2023/v19i6665

Amiyani, R., & Widjajanti, J. B. (2018, September). The Excellence of Guided Discovery Learning on Mathematical Knowledge-Based, Skill-Based, and Attitude. *Journal of Physics: Conference Series,* 1097, 012145. https://doi.org/10.1088/1742-6596/ 1097 /1/012145

Aranas-Romulo, J. (2015). Issues on the Implementation of the K+12 Curriculum. Cugman, Cagayan de Oro City.

Balagtas, M. U., Garcia, D. C. B., & Ngo, D. C. (2019, August 10). Looking through Philippines's K to 12 Curriculum in Mathematics and Science vis-a-vis TIMSS 2015 Assessment Framework. EURASIA *Journal of Mathematics, Science and Technology Education*, 15(12). https://doi.org/10.29333/ejmste/108494

Barana, A., Boetti, G., & Marchisio, M. (2022, January 24). Self-Assessment in the Development of Mathematical Problem-Solving Skills. *MDPI.* https://doi.org/ 10.3390/educsci12020081

Birgin, O., & Uzun Yazıcı, K. (2021, February 8). The effect of GeoGebra software–supported mathematics instruction on eighth-grade students' conceptual understanding and retention. *Journal of Computer Assisted Learning,* 37(4), 925–939. https://doi.org/10.1111/jcal.12532

Casil, C.J., Chavez, D. M., Gumotud, K., Japon, M. L., Ramos, A. (2018). Assessment on the spiral progression of the k-12 curriculum. https://www.academia.edu /36040423/ASSESSMENT_ON_THE_SPIRAL_PROGRESSION_OF_THE_K-12 _CURRICULUM_In_Partial_Fulfilment_of_the_Requirement_on_Seminar_on_ Educational_Measurement_and_Evaluation_EDAD_206

Chytry, V., & Kubiatko, M. (2021). Pupils' Summative Assessments in Mathematics as Dependent on Selected Factors, *EURASIA Journal of Mathematics, Science and Technology Education,* 2021. https://eric.ed.gov/?id=EJ1309268

Clark, S. (2010). *Jerome Bruner: Teaching, learning and spiral curriculum.* Community and Thought in Education.https://sheldonclark.wordpress.com/wp-content/uploads/2011/07/jerome-bruner-teaching-learning-and-the-spiral-curriculum2.pdf

Corpuz, B.B. (2014): The spiral progression approach in the K to 12 curriculum. *Ochare Tomson-Academia.edu.*https://www.academia.edu/34849755/The_Spiral_ Progression_Approach_in_the_K_to_12_Curriculum

Department of Education (DepEd). (2016). Philippine K to 10 Mathematics Curriculum Guide.

http://lrmds.deped.gov.ph

DepEd Order No. 8 S., 2015. Policy Guidelines on Classroom Assessment for the K to 12 Basic Education Program.

Dio, R. V. (2020, November 30). Exploring Vertical Coherence of Content Topics in Philippine Spiral Kto10 Mathematics Curriculum. *International Journal of Learning, Teaching and Educational Research,* 19(11), 259–282. https://doi.org/ 10.26803/ ijlter.19.11.15

Enikanolaye, A. J. (2021). Effects of Multimedia Instructional Strategy on Senior School Students' Performance and Retention in Mathematics, *Anatolian Journal of Education,* 2021-Oct. https://eric.ed.gov/?id=EJ1315826

Enosh, G. Tzafrir, S. S. and Stolovy, T. (2014). The development of client violence questionnaire (CVQ). *Journal of Mixed Methods Research,* 9 (3), 273-290. https:// doi.org/10.1177/1558689814525263

Frimer, S. (2017). The impact of learner and teacher attitudes and beliefs on fifth-grade learner performance in mathematics (Order No. 10638809). *Available from ProQuest Dissertations & Theses A&I.* (1993516118). https://search.proquest.com/ docview/ 1993516118?accountid=31613

Gómez-Chacón, I. M., Bacelo, A., Marbán, J. M., & Palacios, A. (2023, July 18). Inquiry-based mathematics education and attitudes towards mathematics: tracking profiles for teaching. *Mathematics Education Research Journal*. https://doi.org/10.1007/ s13394-023-00468-8

Igcasama, R. M. (2021, February 3). Teachers And Students' Perceptions On The Implementation Of K-12 Spiral Progression Approach. *IJIET (International Journal of Indonesian Education and Teaching)*, 5(1), 116–124. https://doi.org /10.24071 /ijiet.v5i1.2983

Ihendinihu, U. E. (2020). Effect Of Mastering Learning Instructional Approach On Retention And Attitude Of Secondary School Student In Mathematics. *Journal of the Nigerian Academy of Education*, 14(2). https://journals.ezenwaohaetorc.org/ index.php/JONAED/article/download/1260/1280

Kamarudin, N., Alraqadi, Z., Alhunainic, S., & Zaremohzzabieh, Z. (2021). Assessment Practices of Mathematics Teachers in Oman. *Turkish Journal of Computer and Mathematics Education*, 12(14), 4217-4224. https://www.proquest.com/scholarly-journals/assessment-practices-mathematics-teachers-oman/docview/2623926825/se-

Khasawneh, E., Hodge-Zickerman, A., York, C. S., Smith, T. J., & Mayall, H. (2023). Examining the effect of inquiry-based learning versus traditional lecture-based learning on students' achievement in college algebra. *International Electronic Journal of Mathematics Education, 18(1),* em0724. https://doi.org/ 10.29333/ iejme/12715

K to 12 Mathematics Curriculum Guide (August 2016). Department of Education. https://depedbohol.org/v2/wp-content/uploads/2016/03/Math-CG_with-tagged-math-equipment.pdf

Kültür, Y. Z., & Kutlu, M. O. (2021, December 29). The effect of formative assessment on high school students mathematics achievement and attitudes*. Journal of Pedagogical Research, 5(4), 155–171.* https://doi.org/10.33902/jpr.2021474302

Lekan, A. & Emmanuel, J. (2020). Effects Of Cooperative and Individualized Learning Strategies On Student's Academic Retention In Mathematics In Minna Metropolis, Nigeria State. *GSJ: 8(8), August 2020, Online: ISSN 2320-9186.*

Mehmood, K., Parveen, Q. & Dahar, M. (2019). Effectiveness of Inquiry-Based Method for Teaching Mathematics at the Secondary Level*. Global Social Sciences Review. IV.* 181-187. 10.31703/gssr.2019(IV-III).23. https://www.researchgate.net/publication/344654722_Effectiveness_of_Inquiry-Based_Method_for_Teaching_Mathematics_at_the_Secondary_Level/fulltext/5fe3ac40a6fdccdcb8f714d6/Effectiveness-of-Inquiry-Based-Method-for-Teaching-Mathematics-at-the-Secondary-Level.pdf

Mutmainah, M., Rukayah, R., & Indriayu, M. (2019, March 1). Effectiveness of experiential learning-based teaching material in Mathematics. *International Journal of Evaluation and Research in Education (IJERE), 8(1), 57*. https://doi.org/ 10.11591/ijere.v8i1.15903

Oginni, O., Akinola, A., Fadiji, A. & Amole, P.. (2021). Effects of Mastery Learning Strategy on Secondary

School Students Performance in Mathematics. *European Journal of Education and Pedagogy. 2. 59-63.* 10.24018/ejedu. 2021.2.5.171.

Ogwari, P., Mendoza-Role, E., & Amimo, C. (2020, August 6). Effect of Personalized Learning on Mathematics Performance among Secondary Schools in Awendo Sub-County, Kenya. *East African Journal of Education and Social Sciences July to September 2020, 1(2), 98–108.* https://doi.org/10.46606/eajess2020v01i02.0025

Orale, R. & Uy, E. (2018). When the Spiral is Broken: Problem Analysis in the Implementation of Spiral Approach in Teaching Mathematics. https://www. researchgate.net/publication/327232436_When_the_Spiral_is_Broken_Problem_Analysis_in_the_Implementation_of_Spiral_Approach_in_Teaching_Mathematics

Penazzi. (2015). Retention in Mathematics students: problems and possible approaches. *University of Central Lancashire, Preston, Lancashire, PR1 2HE UK,* Article https://pops.uclan.ac.uk/index.php/ujpr/article/view/329/133.

Quijano, Y. S. & Technical Working Group on Curriculum (2012). Orientation for K to 12 Division Coordinators. DepED Complex. 20 April 2012. https://www.scribd.com/document/211824307/K-to-12-Curriculum

Resurrecion, J. & Adanza, J. (2015). Spiral progression approach in teaching science in selected private and public schools in cavite. https://www.dlsu.edu.ph/wp-content/ uploads/pdf/conferences/research-congressproceedings/2015/LLI/017LLI_Resurre cion_GF.pdf

Samron & Arua, A.L. (2021). The Effect of Guided Discovery Learning Model towards the Mathematics' Critical Thinking Ability on Secondary School Students. *Journal of Mathematical Pedagogy, 2 (2), 59-67. ISSN 2715-7458 E-ISSN 2715-7466*

Santos, J. & Boyon, M. (January 29, 2020). Effect of Inquiry-based Lessons on STEM Students' Learning Competencies on Limits and Continuity. *PEOPLE: International Journal of Social Sciences,* Available at SSRN: https://ssrn.com/abstract=3557525

Sen, C., Ay, Z. S., & Güler, G. (2021). The Effectiveness of Inquiry-Based Learning on Middle School Students' Mathematics Reasoning Skill*, Athens Journal of Education, 2021-Nov.* https://eric.ed.gov/?id=EJ1316319

Simamora, R. E., Saragih, S., & Hasratuddin, H. (2018, November 28). Improving Students' Mathematical Problem-Solving Ability and Self-Efficacy through Guided Discovery Learning in Local Culture Context.https://doi.org/ 10.12973 /iej me /3 966

Sun, L., & Xiao, L. (2023). An SEM Model of Learning Engagement and Basic Mathematical Competencies Based on Experiential Learning. *Applied Sciences, 13(6), 3650.* https://doi.org/10.3390/app13063650

Tong, D. H., Loc, N. P., Uyen, B. P., & Cuong, P. H. (2019). Applying experiential learning to teaching the equation of a circle: a case study. *European Journal of Educational Research, 8(4), 239-255.* https://doi.org/10.12973/eu-jer.9.1.239

Ubas, J., Rellon, L, & Bonghanoy, G. (2019). The individualized learning in Mathematics among Badjao children in Matina Aplaya, Davao City. *University of Mindanao International Multidisciplinary Research Journal, 4(1), 28–33.* https://journal.umindanao.edu.ph/wp-content/uploads/2019/12/419-The-Individualized-Learning-in-Mathematics-among-Badjao-Children-in-Matina-Aplaya

United Nations Educational, Scientific and Cultural Organization (2002). Teaching and learning for a sustainable future. https://unesdoc. unesco.org /ark:/48223/pf000012 5238

Venkatraman, S., Overmars, A., & Wahr, F. (2019, July 23). Visualization and Experiential Learning of Mathematics for Data Analytics. *MDPI.* https://doi.org/10.3390 /computation7030037

Vlădescu, C. (2023). The relationship between mastery learning models and academic achievement in mathematics. *International Electronic Journal of Mathematics Education, 18(4)* https://doi.org/10.29333/iejme/13705