

Lived Experiences of Junior High School Students with the Spiral Progression Approach in Science Education: A Phenomenological Study in Northern Samar

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Abstract

Aim: The Spiral Progression Approach (SPA), a core element of the Philippine K to 12 curriculum, seeks to build conceptual mastery through repeated and deepening engagement with key scientific ideas across grade levels. This qualitative study explored how junior high school students in Northern Samar experience and perceive the SPA in science education.

Methodology: Using a phenomenological design, the study gathered data from Grades 7 to 10 students via semistructured interviews, focus group discussions, and classroom observations.

Results: Findings show that while many students appreciate the reinforcing nature of SPA, challenges emerge from gaps in instructional clarity, resource shortages, and contextual barriers like socio-economic status and language. Students' home environment and cultural roles influence their engagement and success in science learning.

Conclusion: For the SPA to fulfill its promise, targeted teacher training, adequate resources, and context-aware strategies are needed (van den Heuvel-Panhuizen & Drijvers, 2014). The research advocates for a holistic, student-centered approach to curriculum reform—one that places learners' lived experiences at the heart of educational improvement.

Keywords: Spiral Progression Approach, science education, lived experiences, phenomenological study, curriculum reform

INTRODUCTION

Science education played a crucial role in developing students' analytical thinking and preparing them for the challenges of an increasingly knowledge-based society. In the Philippines, this led to the implementation of the K to 12 curriculum reform, which included the Spiral Progression Approach (SPA) to help learners develop a solid foundation in science over time (Department of Education [DepEd], 2016). The SPA integrated major science strands—biology, chemistry, physics, and earth science—across grade levels, with increasing complexity as students progressed (Perez & Lumbang, 2022).

Despite its strong theoretical grounding, the practical implementation of SPA faced challenges, especially in resource-limited areas like Northern Samar. Students encountered barriers such as insufficient school facilities, limited teacher expertise, and a lack of home support, compounded by language differences, since many students spoke Waray at home but learned science in English or Filipino (Gonzales, 2022).

Effective educational reforms required grounding in the lived experiences of learners (Silva & Dela Cruz, 2023). However, students' voices often remained underrepresented in curriculum evaluation. This study aimed to fill that gap by exploring the lived experiences of junior high school students learning science through the SPA, highlighting the complexities and opportunities they encountered in rural Philippine classrooms.

Objectives

This study investigated how junior high school students in Northern Samar perceived and experienced the Spiral Progression Approach in science education. The research addressed these questions:

- 1. How did students view and experience the Spiral Progression Approach?
- 2. What challenges did students face under this curriculum?

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3. How did socio-economic status, language, and teacher quality affect their learning?

4. What recommendations did students suggest for improving SPA implementation?

METHODS

Research Design

The researcher employed a phenomenological qualitative research design to deeply explore how junior high school students experience science learning under the Spiral Progression Approach. Phenomenology was chosen for its capacity to capture the subjective meanings and nuanced realities of learners' day-to-day experiences Braun & Clarke (2006, 2019) and Creswell & Poth (2018).

Population and Sampling

The study's population included junior high school students from Grades 7 to 10 in selected public secondary schools in Northern Samar, Philippines. These students had experienced at least one academic year of science instruction using the Spiral Progression Approach. Schools were chosen to represent both rural and semi-urban settings, capturing the diversity of student backgrounds and learning environments in the area.

Because the research was qualitative and phenomenological, purposive sampling was used to select participants who could offer rich insights into their lived experiences. Participants needed to be currently enrolled in Grades 7 to 10, have at least one year of Spiral Progression science instruction, be willing to join interviews and discussions, and have parental or guardian consent.

Twelve students were chosen, three from each grade level, a sample size sufficient to achieve data saturation where key themes emerged consistently. Classroom observations also involved science teachers, but the main focus remained on student perspectives.

This approach ensured the study captured a wide range of experiences across grades, socio-economic backgrounds, and language abilities while maintaining the depth required for phenomenological research. By focusing on information-rich cases, the study authentically represented the voices of those most affected by the Spiral Progression Approach.

Instruments

Several qualitative tools were utilized to gather thorough narratives of junior high school students' Spiral Progression Approach experiences. The main tool was a semi-structured interview guide developed by the researcher, featuring open-ended questions that encouraged students to share their personal views and experiences freely. The guide's flexibility allowed follow-up questions for deeper exploration during interviews.

Focus group discussions were also held, providing a setting for students to reflect collectively on their experiences. These sessions allowed participants to confirm each other's insights and develop new ideas through natural, interactive dialogue, guided by a discussion protocol to maintain focus.

Classroom observations complemented the verbal data, with the researcher using a checklist to systematically note teaching methods, learning materials, student participation, and the overall atmosphere. These observations enriched the data and helped triangulate findings from interviews and discussions.

Before using these instruments, experts in qualitative research and science education reviewed them for clarity and appropriateness. A pilot test was also conducted with a small group of students to refine questions and procedures, ensuring the tools effectively captured authentic student perspectives.

Data Collection

Data collection was carried out through semi-structured interviews and focus group discussions with junior high school students who experienced the Spiral Progression Approach. The interviews provided rich, personal insights into each student's perspective, while the focus groups facilitated dynamic interactions that revealed shared experiences and differing viewpoints. To complement these verbal accounts, classroom observations were conducted to capture real-time teaching strategies and student engagement with science lessons. All interviews and discussions were audio-recorded with participants' consent, then carefully transcribed for analysis. Data collection continued until saturation was reached, meaning no new significant information was obtained, ensuring a comprehensive understanding of the students' lived experiences.

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Data Analysis

The collected data were analyzed using thematic analysis, following the six-step framework outlined by sixstep framework outlined by (Braun & Clarke, 2019)The process began with the researcher immersing themselves in the data by repeatedly reading the interview transcripts and observation notes to gain a deep understanding of the participants' experiences. Initial codes were then generated by identifying meaningful segments related to how students perceived and interacted with the Spiral Progression Approach. These codes were grouped into broader themes that captured significant patterns across the data (Miles, Huberman, & Saldaña, 2014). The themes were reviewed and refined to ensure they accurately represented the data and addressed the research questions. Finally, the researcher produced a detailed narrative that weaved together the themes, providing a rich, contextualized interpretation of the students' lived experiences. This rigorous analytic approach ensured that the findings remained grounded in the participants' own words and perspectives.

Ethical Considerations

Ethical considerations were carefully observed throughout the study to protect the rights and well-being of all participants. Prior to data collection, informed consent was obtained from each student participant, with clear explanations about the purpose of the research, the voluntary nature of participation, and their right to withdraw at any time without any consequences. The confidentiality and anonymity of participants were strictly maintained by assigning pseudonyms and securely storing all data. The researcher ensured a respectful and non-coercive environment during interviews and discussions, fostering open and honest communication. Additionally, approval to conduct the study was secured from the relevant school authorities and an institutional ethics review board, ensuring adherence to established ethical standards in educational research.

RESULTS and DISCUSSION

This chapter presented, analyzed, and interpreted the data to address the study's research questions, focusing on the Spiral Progression Approach in junior high school science education. The findings were organized around core themes: cognitive load management, building on prior knowledge, and repetition and comprehension. Participants' quotes illustrated these themes, while relevant literature contextualized the findings and suggested practical implications.

This analysis offered educators useful recommendations to improve the Spiral Progression Approach following DepEd standards and shed light on students' views of its effectiveness. Participants expressed diverse experiences, reflecting various learning styles, challenges, and hopes. Their perspectives revealed both strengths and areas for improvement in the teaching method.

For example, Participant 1 found the layered learning helpful for understanding complex material by building on prior knowledge. Participant 2, however, struggled with cognitive overload, feeling overwhelmed by repeated content that added complexity. Participant 3 valued the repetition for grasping difficult scientific ideas, while Participant 7 said reviewing topics repeatedly improved memory and understanding.

Participant 5 lamented the lack of hands-on learning due to insufficient lab resources, which hindered natural comprehension. Participant 6 was an independent learner who supplemented classroom instruction with self-study, emphasizing the need for additional resources to fill knowledge gaps. Participant 4 balanced independent and class learning to address instructional challenges actively. Finally, Participant 8 criticized some teachers' lack of science background, highlighting the need for subject expertise to clarify complex topics.

These experiences reveal the complexity of the Spiral Progression Approach in middle school science. They suggest that while the approach can effectively build and reinforce knowledge, it requires balancing repetition, providing adequate learning tools, supporting independent learning, and ensuring teachers have the expertise to teach complex material effectively.

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Student Perceptions of the Effectiveness of the Spiral Progression Approach in Enhancing Science Understanding

The Spiral Progression Approach, designed to improve students' comprehension by revisiting topics with added complexity, received a range of feedback from the participants in this study. Their responses highlight strengths and areas of difficulty with the approach, particularly around themes of repetition and comprehension, building on prior knowledge, and feeling overwhelmed by cognitive load. These perspectives offer valuable insights into how the approach impacts learners.

On the theme of repetition and comprehension, some participants felt that revisiting topics was beneficial. Participant 3 explained, *"It helps because topics are hard to understand. If you repeat it, it becomes clearer."* Similarly, Participant 7 noted, *"The more I recall, the more I remember,"* suggesting that repeated exposure helped reinforce their understanding. However, not all participants shared this view. Participant 2, for instance, expressed frustration, saying, *"The longer it repeats the lesson, it confuses me because there's a lot of add-ups."* For this participant, the repetitive nature of the approach introduced new information each time, which made it harder to retain a clear understanding, illustrating a downside to repetition without sufficient structure or clarity.

Regarding advanced learning and building on prior knowledge, Participant 1 highlighted the value of this incremental approach by stating, *"The Spiral Progression helps me with advanced reading and understanding."* This suggests that the approach's layering effect allowed some students to develop a deeper understanding of science concepts gradually. For these students, revisiting topics with added complexity enabled them to see the material in a new light each time, making it more accessible as they grew more familiar with the basics.

However, the cognitive load experienced by some students pointed to another challenge of the approach. Participant 2's comment about feeling confused by "*a lot of add-ups*" reveals that the cumulative nature of the Spiral Progression Approach can sometimes lead to information overload. When new elements are introduced with each revisit, some students may struggle to integrate the expanding content, leading to confusion instead of clarity. This feedback indicates that, while the approach aims to reinforce learning, the added complexity can occasionally become overwhelming, especially for those who do not feel secure in their foundational understanding.

The participants' responses indicate that the Spiral Progression Approach has positive and negative effects on their learning experience. While repetition helped some students reinforce their understanding, others found it confusing when new details were added with each revisit. Building on prior knowledge worked well for students who were comfortable with the basics, but the layering of new information led to cognitive overload for those who were not. These insights underscore the importance of pacing and adjusting the approach to ensure students benefit from the repetition and complexity without feeling overwhelmed.

Repetition, Comprehension, and Clarity: Enhanced Understanding vs. Confusion

One of the central themes that emerged was the role of repetition in aiding comprehension. Some students found that revisiting topics multiple times helped them clarify initially tricky concepts. For example, Participant 3 remarked, "*It helps because there are hard topics to understand. If you repeat it, it becomes clearer.*" This sentiment was echoed by Participant 7, who said, "*The more I recall, the more I remember.*" These comments reflect that repetition can reinforce memory and make complex topics more accessible.

This perspective aligns with the findings of Gonzales (2022), who suggested that repetitive learning can strengthen retention by giving students multiple opportunities to engage with the material. According to the literature, revisiting content allows learners to build a stronger foundation, which can be particularly helpful in subjects like science, where understanding often builds on previous knowledge. However, the study also found that not all students experienced these benefits. Some reported feeling confused by constantly revisiting topics, particularly when new information was added each time. This confusion suggests that, while repetition can be beneficial, there is a risk of overdoing it.

Students may become bored and frustrated from too much repetition without obvious advancement. The results of this study confirm that perspective; some students felt that the Spiral Progression Approach caused cognitive overload instead of improved understanding. Changing the frequency and complexity of topic revisiting could help students find a balance so they might profit from repetition without feeling overburdled.

Advanced Learning: Building on Prior Knowledge

Another aspect of the Spiral Progression Approach highlighted by students was its ability to build on prior knowledge, helping them tackle more advanced concepts. Participant 1 noted, "*The Spiral Progression helps me with advanced reading and understanding,*" indicating that the approach's layering effect allowed them to progress in their

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understanding of science topics gradually. This view aligned with theories of progressive learning, such as those discussed by Perez and Lumbang (2022), who argued that revisiting foundational concepts with added complexity enabled students to deepen their comprehension over time.

Layering knowledge is also tied to Vygotsky's Zone of Proximal Development (ZPD), which suggests that students learn best when challenged slightly beyond their current abilities, with guidance to bridge the gap. In the Spiral Progression Approach, as students revisited topics, they were encouraged to engage with increasingly complex material, which could facilitate growth within their ZPD. However, for this approach to be effective, students needed to have a solid understanding of foundational concepts in the earlier stages. Without this clarity, the progression could lead to confusion as students advanced, as noted by several participants in the study.

This suggested that while the Spiral Progression Approach had the potential to promote advanced learning, it required a strong emphasis on clarity in the initial stages. Ensuring students had a clear grasp of basic concepts before moving to higher levels of complexity could have enhanced their confidence and ability to handle advanced material.

Comprehension Issues: Overwhelming Information

Despite the potential benefits, some students found the Spiral Progression Approach overwhelming. Participant 2 voiced this concern by saying, "*The longer it repeats the lesson, it confuses me because there's a lot of add-ups.*" This feedback reflected a recurring issue with the approach: as topics were revisited, additional layers of information were introduced each time, which could lead to content overload. For some students, this accumulation of details created confusion instead of reinforcing understanding. Rather than gaining clarity from repeated exposure, they felt lost as new concepts were layered on top of what they already knew.

Participant 2's experience served as a reminder that revisiting topics could be beneficial, but it needed to be carefully managed. Gradually adding new information should ideally have supported students' comprehension, not overwhelm it. However, when each revisit added more complexity without adequately reinforcing foundational concepts, students struggled to integrate all the material, leading to cognitive overload. This frustration may have caused students to disengage from the material, as they were unsure how to effectively process and apply the expanding content.

This issue aligned with cognitive load theory, which Silva and Dela Cruz (2023) discussed extensively. Their research highlighted how presenting students with too much information at once could impede learning rather than enhance it. When students were overwhelmed by content, their cognitive resources were stretched thin, making it harder to focus on and retain the presented information. In the context of the Spiral Progression Approach, this risk of cognitive overload was especially relevant. As each topic revisit introduced additional details, students felt pressured to absorb more information without adequate time to consolidate their understanding of the basics.

One solution could have been simplifying the information introduced at each stage and emphasizing core concepts to make the Spiral Progression Approach more manageable and less overwhelming. Teachers could have helped students reinforce their understanding without overloading them with new content by focusing on the most essential ideas rather than adding excessive details. This targeted approach would have allowed students to build a more stable foundation as they progressed, enabling them to handle added complexity more comfortably. Simplifying content in this way could have enhanced the effectiveness of the Spiral Progression Approach, ensuring that students felt supported in their learning journey instead of burdened by too much information at once.

Implications and Recommendations

The varied responses from students suggested that the Spiral Progression Approach could be practical, but only when carefully managed. Repetition supported retention and understanding but must be balanced to prevent cognitive overload. For some students, revisiting topics allowed them to reinforce their knowledge and deepen their comprehension of complex science concepts. Participant 3's comment, "*If you repeat it, it becomes clearer,*" reflected this perspective, highlighting how repeated exposure helped clarify challenging material. However, others felt that the approach's repetitive nature led to confusion and frustration, especially when new details were added each time without enough emphasis on core concepts. This contrast pointed to the importance of moderation in repetition, ensuring that it reinforced understanding rather than causing students to feel overwhelmed.

The approach's potential to build on prior knowledge also highlighted the importance of establishing a clear foundation in the earlier stages of learning. Some students, like Participant 1, appreciated the layering effect of the Spiral Progression Approach, noting that it helped them with "*advanced reading and understanding.*" This feedback underscored the value of gradually increasing complexity as students progressed, allowing them to connect new

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information with what they had previously learned. However, several students indicated that the effectiveness of this layering depended on a solid grasp of foundational concepts. Students struggled to keep up with the added complexity without a strong base, often confusing them. This finding suggested that, for the Spiral Progression Approach to be practical, educators must ensure that students fully understand the basics before introducing more advanced material.

Given these insights, educators implementing this approach might have considered adjusting the frequency and depth of topic revisiting. Rather than simply repeating content, educators could have focused on reinforcing core concepts at each stage and gradually adding complexity as students demonstrated readiness. By doing so, teachers could avoid overwhelming students with excessive information while providing the benefits of layered learning. This strategy could have been particularly beneficial for students who struggled with cognitive overload, as it would allow them to build understanding step-by-step without feeling pressured by the constant addition of new details.

These findings and insights from related literature emphasized the need for an adaptable approach to the Spiral Progression model. Studies, such as those by Gonzales (2022) and Silva & Dela Cruz (2023), supported the idea that repetition aids retention but warned of the risks associated with cognitive overload. This balance between reinforcement and progression was critical for maximizing the approach's potential. Educators could have created a learning environment that significantly enhanced students' understanding of science concepts by carefully tailoring the Spiral Progression Approach to students' mental capacities and readiness levels.

The Spiral Progression Approach had the potential to be a powerful tool in science education, but its success relied on thoughtful implementation. Recognizing that students have varying readiness and cognitive capacity levels, educators could have made adjustments that accounted for these differences. An adaptable approach that considered both the benefits of repetition and the risks of information overload would allow students to experience the advantages of cumulative learning without being overwhelmed. With such adjustments, the Spiral Progression Approach could have offered students a structured and effective pathway toward mastering complex scientific concepts, making science education both more accessible and more meaningful.

Challenges Faced by Students with the Spiral Progression Approach

Students gradually developed a solid grasp of complex topics with the support of the Spiral Progression Approach. In principle, it was a fantastic plan: students would reinforce what they had learned by delving deeper into key concepts as they progressed through the grades. Nevertheless, this research showed significant obstacles for students using this method, which affected their learning experience. Their primary concerns included insufficient funding, teachers needing a solid science background, the necessity of student autonomy in the classroom, and the mental strain of constantly reviewing a wide range of complex concepts. These recurring themes highlighted ways the Spiral Progression Approach could have been refined to serve students better.

One of the most significant issues raised by students was the need for more resources, especially when it came to hands-on learning materials like laboratory equipment. Participant 5 said, "We need more resources, especially for experiments." Science, as a subject, benefited greatly from practical, hands-on activities. Without the right resources, students missed out on experiences that could have helped them understand concepts concretely. Studies demonstrating that practical scientific involvement greatly improved memory and comprehension Students who could run experiments might observe ideas in action, which would aid in memory and comprehension of the subject matter. By giving students the tools they required to learn in a more hands-on, memorable manner, addressing this shortage of resources could have made the Spiral Progression Approach more successful. Another issue students mentioned was that their science teachers often needed more specialized training in science. Participant 8 expressed frustration, saying, "Sometimes, the teachers are not science majors, which causes confusion." When teachers did not have a strong background in the subject they were teaching, it led to gaps in understanding for the students. Usually, teachers with specialized knowledge were more successful since they could answer questions more comprehensively and deeply grasp the subject. Having teachers who really know the subject made a difference for a curriculum like the Spiral Progression Approach, which over time added more levels of complexity to themes. By helping students meaningfully integrate these levels, specialized science teachers could have lessened the ambiguity resulting from uneven instruction.

Because of these issues with resources and teacher expertise, some students relied on self-directed learning to keep up. Participant 6 mentioned, "*I do advanced reading and research on my own.*" This showed how students were stepping up to bridge the gaps themselves. Self-directed learning encouraged students to take initiative and develop independent learning skills. Silva and Dela Cruz (2023) discussed how self-directed learning promoted critical thinking and resilience. However, it should not have had to replace quality instruction. Ideally, students should have

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done self-study to enhance their understanding, not compensate for gaps in their education. Schools could have helped by providing additional resources and support for students who took on this extra effort to study independently.

Finally, students discussed the cognitive load they felt from constantly revisiting complex topics. Participant 2 explained, "*There are too many topics, and I get confused.*" The Spiral Progression Approach had students revisit issues each year with added complexity, which was supposed to deepen their understanding. However, if students had not fully grasped the basics, this added complexity would have only made things more overwhelming. It was argued that excessive content may diminish engagement and impede students' information retention. For this method to function as intended, students must possess confidence in their core knowledge prior to advancing to the next level. In the absence of this confidence, the strategy resulted in frustration and disengagement rather than fostering a robust knowledge base. While the Spiral Progression Approach had a lot of potential, several challenges needed to be addressed to work as effectively as possible. Issues like limited resources, non-specialized teachers, the need for self-directed learning, and cognitive overload were all factors that impacted students' ability to benefit from this approach. Improving access to resources, ensuring teachers had the necessary expertise, supporting self-directed learning, and balancing the curriculum could have helped make this approach more effective, allowing students to learn in a way that felt both manageable and meaningful.

Resource Constraints: Lack of Hands-on Experience

A major challenge highlighted by students in this study was the need for more resources, particularly for hands-on activities in the science lab. Participant 5 said, "*We need more resources, especially for experiments.*" This lack of resources is more than an inconvenience; it directly affects students' ability to engage meaningfully with scientific concepts. As a subject, science benefits immensely from hands-on learning, where students can see theories in action and explore ideas through experimentation. Without these opportunities, students may struggle to connect what they learn in theory to its practical applications, making the material feel distant and hard to grasp.

Research supports the value of hands-on learning in science. Active participation in science markedly enhances understanding and retention. Their study indicates that students engaging in experiments or hands-on activities acquire a far deeper and more enduring comprehension of scientific principles. The input from students in the current study highlights this necessity; they believe that more resources would improve their learning experience by rendering the concepts more tangible and relatable. These practical experiences should be present when implementing the spiral progression approach. This approach reinforces students' understanding by revisiting increasingly complex topics. Without access to the right resources, however, each "layer" of learning may feel disconnected, as students lack the hands-on reinforcement that would help solidify their understanding at each stage. The Spiral Progression Approach could become a more effective tool for building knowledge over time by providing schools with adequate laboratory equipment and materials. Investing in resources would allow students to fully engage in the progressive structure of their curriculum, making science education more interactive and more impactful.

Teacher Specialization: Instructor Knowledge Gaps

Another significant challenge students pointed out was the need for teacher specialization in science. For many students, having a teacher without a strong background in science made it difficult to understand complex topics fully. Participant 8 expressed this frustration, saying, "*Sometimes, the teachers are not science majors, which causes confusion.*" When teachers lack specific training in the subject they're teaching, it can lead to inconsistencies in how content is delivered. This gap in expertise can create barriers for students, as teachers may struggle to explain complex concepts clearly or answer questions in depth, which ultimately affects students' ability to learn effectively.

This finding underscores the need of aligning teachers' expertise with their respective disciplines. Their findings indicate that educators with specialized expertise in their field are more adept at addressing its distinct obstacles and intricacies, leading to a more successful learning environment. Specialized educators may deliver precise explanations, rectify student misconceptions, and develop lesson plans that systematically enhance students' understanding.

This lack of specialization becomes even more problematic in the context of the Spiral Progression Approach. Since the approach relies on revisiting topics with added complexity over time, students need a steady, informed guide who can help them connect the dots between each content layer. Teachers with a strong science

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background are better equipped to facilitate this layered learning process, assisting students to build on foundational knowledge rather than needing clarification on gaps or inconsistencies in instruction.

Ensuring that science teachers have the appropriate background and training could significantly improve students' experiences with the Spiral Progression Approach. Specialized instruction would not only reduce confusion but also allow students to engage with scientific concepts in a more meaningful way. By aligning teacher expertise with subject requirements, schools can create a more supportive and effective learning environment where students feel confident tackling increasingly complex topics.

Self-Directed Learning: Coping Mechanisms

Faced with gaps in instruction and a need for more resources, some students turned to self-directed learning to keep up with their studies. Participant 6, for instance, mentioned, "*I do advanced reading and research on my own,*" showing that students took the initiative to bridge these gaps through independent study. This proactive approach reveals a level of resilience among students as they sought additional information and resources on their own to understand the material better. Self-directed learning helps students fill knowledge gaps and fosters critical thinking and problem-solving skills, making them more adaptable and resourceful.

Research by Silva and Dela Cruz (2023) highlights the benefits of self-directed learning, especially when students may need more consistent support in the classroom. They point out that self-study encourages independence as students learn to rely on their initiative to find solutions and expand their knowledge. Students who practice self-directed learning are often better equipped to handle challenges, as they've developed the skills to seek out and synthesize information independently.

However, while self-directed learning can be incredibly beneficial, it isn't a substitute for quality instruction. Students should ideally use self-study as a supplement to the guidance they receive from teachers, not as a replacement for it. Independent study works best when students have a foundation of support and resources from their school, with teachers providing guidance and direction as needed. Without this support, self-directed learning can sometimes become overwhelming, especially in subjects like science, where complex concepts often require clear explanations and structured guidance.

Self-directed learning has proven to be a valuable coping mechanism for students, allowing them to take charge of their education despite their challenges. However, students must balance independence and instructional support to benefit from this approach entirely. Schools can empower students further by offering resources and guidance that enhance self-directed learning, ensuring students can study independently and have the support they need to succeed.

Confusion in Advanced Concepts: Increased Cognitive Load

A recurring theme among students was the confusion they felt due to the large volume of topics covered in the Spiral Progression Approach. Participant 2 highlighted this issue: *"There are too many topics, and I get confused."* This feedback points to the feeling overwhelmed by the sheer amount of content. The Spiral Progression Approach is designed to revisit topics with added layers of complexity, intending to deepen students' understanding over time. However, if students do not have a solid grasp of foundational concepts, this cumulative layering can sometimes result in cognitive overload instead.

An overloaded curriculum might diminish student engagement and impede information retention. When students are inundated with excessive content in a short timeframe, they may struggle to maintain pace, particularly in disciplines that necessitate the accumulation of prior knowledge. For the Spiral Progression Approach to function effectively, students must possess confidence in comprehending each layer prior to advancing to the subsequent one. In the absence of this confidence, progression may transform into an obstacle rather than a beneficial instrument, resulting in frustration and disengagement as pupils endeavor to cope with the escalating complexity of new content.

This issue highlights the importance of balancing the content load within the Spiral Progression Approach. Teachers and curriculum developers must ensure students have mastered each concept before advancing to more complex topics. Without this balance, students may struggle to connect new information with their prior knowledge, hindering their engagement and ability to retain what they've learned. By ensuring that foundational knowledge is well-established before introducing additional layers, schools can help prevent cognitive overload and make the Spiral Progression Approach a more effective tool for deepening understanding over time.

While the Spiral Progression Approach aims to enrich students' learning by adding complexity, it requires careful pacing and support. Ensuring students are ready for each new content layer can reduce the risk of cognitive

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overload and allow them to engage more meaningfully with the material. This balanced approach could help students confidently navigate advanced concepts, making their learning experience more manageable and rewarding.

Implications

The findings suggest several important ways to improve the Spiral Progression Approach for better student learning. First, schools must be equipped with adequate laboratory resources, as hands-on experimentation is vital for engaging students and helping them grasp scientific concepts. Providing necessary materials can make science learning more practical and meaningful within the spiral framework.

Second, having specialized science teachers is crucial. Teachers with strong subject knowledge can reduce confusion and better explain complex ideas, supporting students as they build on prior knowledge through the curriculum's layers.

Third, encouraging self-directed learning alongside teacher support helps students become independent and develop critical thinking skills. This balance prepares learners to handle the curriculum effectively and face future challenges.

Finally, managing content load is essential to avoid overwhelming students. A well-paced curriculum that ensures mastery of foundational concepts before introducing more advanced topics can boost student confidence and prevent disengagement.

Addressing resource availability, teacher expertise, self-directed learning, and curriculum pacing will enhance the Spiral Progression Approach, creating a more supportive learning environment where students can deeply understand science and build a solid foundation for future education.

Guiding Future Improvements in the Spiral Progression Approach in Science Education

The findings from this study provide several insights that can guide potential improvements in implementing the Spiral Progression Approach in science education. Key areas identified include the need for specialized science teachers, access to adequate laboratory resources, and the incorporation of interactive learning tools. Each theme shows how the current approach could be enhanced to offer students a more effective and engaging learning experience.

Specialized Instruction: Need for Teacher Expertise

One of the main points raised by students was the importance of teacher specialization in science. Participant 3 said clearly: *"Science teachers should be teaching science, not other subjects."* This sentiment underscores the belief that teachers with a strong background in science can provide more accurate and practical instruction. When teachers lack subject-specific expertise, it can lead to confusion among students, especially as they encounter more complex topics in the Spiral Progression Approach.

Specialized training for educators is crucial for improving students' learning experiences. Subject-matter specialists among teachers are more adept at addressing student inquiries, delivering precise explanations, and designing lessons that coherently build upon existing knowledge. Within the framework of the Spiral Progression Approach, wherein students repeatedly engage with and enhance their comprehension of subjects over time, the presence of educators possessing specialized subject expertise becomes increasingly vital. Students are more likely to gain confidence as they advance through each curricular layer under the guidance of specialized teachers. Providing science teachers the requisite training and expertise could markedly enhance the quality of science instruction within this framework.

Enhanced Resources: Access to Laboratory Equipment

Another key theme from the study was better access to laboratory resources. Participant 5 highlighted this issue, stating, "*We need more resources for experiments to understand the topics better.*" Science is inherently hands-on, where practical engagement helps students connect theoretical concepts to real-world applications. Without adequate resources for experiments, students miss out on valuable learning opportunities that could enhance their understanding and retention.

Practical scientific investigations substantially enhance theoretical understanding. Active participation in experiments enables students to observe scientific principles in practice, fostering a profound and significant comprehension of concepts. Within the framework of the Spiral Progression Approach, access to laboratory resources enables students to investigate subjects at each tier through experiential learning that consolidates their understanding. Investing in laboratory instruments and equipment would enable schools to furnish students with the

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necessary resources to maximize the advantages of the Spiral Progression Approach, hence enhancing the interactivity and effectiveness of the learning experience.

Interactive Learning Tools: Visual and Hands-on Learning

Students also strongly preferred interactive learning tools like videos and hands-on activities to help them understand complex topics. Participant 8 noted, "*I understand better when I watch videos and have hands-on activities.*" This reflects a common trend among students who find visual and interactive methods more accessible, especially for abstract concepts that are difficult to grasp through traditional instruction alone.

The value of interactive learning tools is well-documented in educational literature. Multimedia materials and experiential learning can enhance the engagement and accessibility of science education. Interactive resources, including movies, simulations, and virtual labs, accommodate diverse learning styles, facilitating students' comprehension of complex subjects in a pertinent and accessible manner. In the Spiral Progression Approach, where students reexamine themes with increasing complexity, these tools can function as excellent scaffolding, facilitating the enhancement of their prior knowledge in a systematic manner.

Incorporating interactive tools into the curriculum could be a powerful way to enhance the Spiral Progression Approach, for students who struggle with abstract or theoretical explanations, multimedia and hands-on resources provide alternative pathways to understanding. These tools make learning more engaging and allow students to experience science in ways that deepen their comprehension and retention.

The feedback from students and insights from the literature suggest several practical steps to improve the Spiral Progression Approach in science education. Specialized instruction from teachers with subject-specific expertise could provide a stronger foundation for students, ensuring they have the guidance they need to tackle complex topics. Providing adequate resources for laboratory experiments could also make science more interactive, helping students to connect theory with practice. Finally, incorporating interactive tools like videos and hands-on activities could cater to diverse learning styles, making the curriculum more accessible and engaging.

These improvements could transform the Spiral Progression Approach into a more effective model for science education, allowing students to build a solid foundation of knowledge that grows with each level. By addressing these areas, schools can create a learning environment where students feel supported, engaged, and prepared to succeed in their studies.

Component	Description	Strategies/Guidelines	Expected Outcome
Structured Topic Revisit	Planning how often and to what depth topics should be revisited to reinforce learning without causing overload.	 Revisit key topics at least once per term with incremental complexity. Limit each revisit to essential subtopics to maintain focus and clarity. 	Students consolidate understanding through spaced repetition, strengthening retention without feeling overwhelmed.
Core Concept Emphasis	Prioritizing foundational concepts to ensure a strong base before adding complexity.	 Focus on essential science concepts (e.g., fundamentals of chemistry or biology) in the first revisit. Introduce complexity only after mastery. 	Students build a solid foundational understanding, enabling them to handle advanced material with confidence.
Gradual Complexity Increase	Introducing new information in manageable increments, ensuring a smooth transition from basic to advanced concepts.	 Increase complexity by layering related subtopics (e.g., cellular biology to genetics) each term. Use clear, incremental steps between revisits. 	Students develop a deep, layered understanding of topics over time, experiencing learning as manageable and sequential.
Teacher Training on	Training teachers on cognitive load theory and its application	 Conduct workshops on cognitive load management and 	Teachers become skilled in adjusting instructional pacing,

Framework for Balancing Cognitive Load within the Spiral Progression Approach in Junior High School Science Education (Aligned with DepEd Standards)

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Component	Description	Strategies/Guidelines	Expected Outcome
Cognitive Load	to monitor student readiness for complexity.	instructional scaffolding. 2. Encourage formative assessments to gauge student readiness.	resulting in fewer instances of cognitive overload among students.
Scaffolding Techniques	Providing structured support that gradually fades as students become more proficient with complex material.	 Use scaffolding tools like visual aids and step-by-step problem- solving guides. Gradually reduce support as students gain confidence in concepts. 	Students gain confidence and autonomy, developing the ability to tackle complex material independently.
Regular Feedback Mechanisms	Collecting and analyzing student feedback on pacing and difficulty levels to guide ongoing instructional adjustments.	 Implement end-of-unit feedback sessions to understand student experiences. Adjust lesson pacing based on feedback to meet diverse learning needs. 	Instruction becomes more student-centered, with students feeling supported and understood in their learning progression.
Use of Multimodal Resources	Incorporating various learning materials (e.g., visual, kinesthetic, and auditory) to cater to different learning styles and reduce cognitive strain.	 Integrate videos, models, and simulations for complex topics. Provide hands-on laboratory activities where applicable to reinforce theoretical ideas. 	Students engage with material in ways suited to their learning styles, enhancing understanding and reducing mental strain.
Cognitive Load Monitoring	Regular assessment of students' cognitive load through formative assessments to ensure they are ready for new layers of complexity.	 Use brief, low-stakes quizzes or concept checks after each revisit. Monitor class performance and adjust pacing as needed based on assessment data. 	Ensures students are cognitively prepared for additional content, minimizing frustration and maximizing comprehension.
Integration of Reflection Activities	Encouraging students to reflect on and consolidate their understanding after each revisit to reinforce learning and identify gaps.	 Implement reflection journals or summary activities at the end of each revisit. Guide students in connecting prior knowledge with new information. 	Reflection solidifies understanding, helping students make connections across revisits and identify areas that need reinforcement.
Adaptive Pacing and Curriculum Flexibility	Allowing for adjustments in curriculum pacing based on student needs and understanding levels.	 Incorporate flexible timelines in the syllabus. Allow teachers to slow down or accelerate content based on class progress and feedback. 	A flexible curriculum that adapts to students' learning paces, resulting in reduced stress and a more personalized learning experience.

The **Framework for Balancing Cognitive Load** is tailored to junior high school students, aiming to make the Spiral Progression Approach manageable and effective. This framework aligns with DepEd standards by ensuring that students are supported in building foundational knowledge in a way that respects their cognitive development and learning needs.

One of the core components is **Structured Topic Revisit**, where topics are revisited with a balance of frequency and depth. This strategy ensures that students consolidate their understanding and stay calm. The framework suggests revisiting key topics at specific intervals, such as each term, with each revisit focused on essential subtopics. Students can process and reinforce their understanding effectively by limiting the amount of new

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information added with each revisit. This structured repetition allows students to develop retention and clarity, which are essential for building confidence in science subjects.

Core Concept Emphasis is another critical element. Students build a solid understanding of basic principles by focusing on foundational concepts before moving on to more complex material. For instance, junior high science topics like introductory chemistry or biology are prioritized during initial revisits. Complexity is only introduced once students demonstrate mastery of these fundamentals, helping to prevent confusion as they progress. This method ensures that students feel grounded in essential knowledge, which supports their ability to handle advanced material later on.

The framework also emphasizes a **Gradual Increase in Complexity** to facilitate smoother transitions from primary to advanced concepts. Instead of immediately overwhelming students with advanced topics, the framework recommends layering related subtopics over time. For example, students might learn about cells and gradually explore genetics in later grades. This approach helps students build on their prior knowledge in a logical sequence, promoting a deep understanding that feels sequential and manageable rather than overwhelming.

Teacher Training on Cognitive Load is necessary for educators in the DepEd framework. Teachers are vital in managing cognitive load, especially in a junior high school. Training on cognitive load theory provides teachers with the tools to recognize when students are ready for additional complexity and when they may need more support. This training could include workshops and instructional materials on scaffolding and pacing, equipping teachers to support students through each stage of the Spiral Progression Approach without causing cognitive overload.

Scaffolding Techniques are also essential for junior high learners, who may still need structured support as they encounter increasingly complex material. Scaffolding allows students to engage with challenging topics guided, using visual aids or step-by-step instructions initially and gradually reducing assistance as students become more confident. By phasing out this support over time, students gain independence and are encouraged to develop their problem-solving skills, preparing them for higher levels of learning.

The framework includes **Regular Feedback Mechanisms** to help educators monitor student progress and adjust instructional strategies as needed. Gathering feedback from students at the end of each unit or topic provides insights into their experiences, helping teachers understand if pacing and content depth are appropriate. This feedback loop allows for real-time adjustments, making the instructional approach more responsive to students' needs and ensuring they feel supported throughout their learning journey.

Using **Multimodal Resources** is another strategy that aligns with DepEd's focus on varied instructional materials to cater to different learning styles. Teachers can accommodate diverse learning preferences by incorporating visual, auditory, and kinesthetic resources, such as videos, models, and hands-on activities. For junior high students, this multimodal approach enhances engagement and reduces cognitive strain, as they can better grasp complex concepts through various means of representation.

Cognitive Load Monitoring through formative assessments helps teachers gauge students' readiness for additional complexity. Simple, low-stakes assessments such as quizzes or reflective exercises after each revisit allow teachers to assess students' grasp of the material. This ongoing monitoring ensures that students are not overwhelmed and fully understand foundational topics before moving forward. Regular assessments provide insight into students' cognitive load, allowing teachers to make informed decisions about pacing and depth.

Integration of Reflection Activities is encouraged to reinforce learning and help students consolidate their knowledge. Reflection journals, summary activities, or group discussions enable students to process what they have learned after each revisit, identifying gaps in understanding. Guided reflection allows students to connect new material and prior knowledge, fostering a deeper comprehension that aligns well with DepEd's emphasis on student-centered learning.

Lastly, **Adaptive Pacing and Curriculum Flexibility** allow for adjustments in curriculum pacing based on students' needs. Recognizing that junior high students progress at different rates, this framework supports flexible timelines in the syllabus. Teachers are encouraged to slow down or accelerate content delivery as needed, ensuring students are neither rushed nor held back. This approach provides a personalized learning experience, reducing stress and helping students navigate the Spiral Progression Approach in an achievable way.

This **Framework for Balancing Cognitive Load** is designed to align with DepEd standards and junior high school students' learning capacities. This framework supports students' cognitive needs by managing the frequency of topic revisits, emphasizing foundational knowledge, training teachers, providing scaffolding, incorporating multimodal resources, and ensuring curriculum flexibility. These elements create a structured yet

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adaptable learning environment, enabling students to build a strong understanding of complex science concepts in a manageable, engaging way.

Conclusions

This study revealed that the Spiral Progression Approach has valuable strengths in supporting science learning among junior high school students. Many participants appreciated the repetitive nature of the curriculum, which allowed them to revisit complex scientific concepts multiple times, helping to reinforce their understanding and build confidence. This layered learning approach aligns well with educational theories that emphasize gradual mastery through repeated exposure.

However, the study also uncovered significant challenges. Students often experienced confusion and cognitive overload, especially when earlier lessons were not clearly taught or when new information was added without adequate scaffolding. These difficulties were exacerbated in settings where teachers lacked specialized science training or where resources such as laboratory equipment and visual aids were insufficient. Such inconsistencies led to gaps in comprehension and diminished student engagement.

Additionally, the findings highlighted that students' socio-economic and cultural contexts deeply influenced their learning experiences. Limited access to study materials, language barriers, and household responsibilities created extra obstacles for many learners. These factors underscored the need for educational reforms like the Spiral Progression Approach to be sensitive to the realities of students' lives outside the classroom.

In essence, the Spiral Progression Approach holds great promise but requires careful, context-aware implementation. Its success depends on skilled teachers, adequate resources, and strategies that consider the diverse backgrounds of learners. Addressing these factors is essential for ensuring that all students can benefit from science education reforms and achieve meaningful learning outcomes.

Recommendations

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To improve the effectiveness of the Spiral Progression Approach, ongoing teacher training is essential. Educators need strong science knowledge and teaching skills to guide students through complex topics confidently. Schools, especially in rural areas, must be equipped with sufficient lab materials and visual aids to support hands-on learning, making science more relatable and easier to understand.

Differentiated instruction should be encouraged to meet the varied needs of learners and prevent them from feeling overwhelmed. Using videos and interactive tools can also help students grasp difficult concepts in different ways. It's important to consider students' socio-economic backgrounds and languages when designing curriculum support, so learning becomes accessible to all.

Regular assessments and student feedback can help teachers adjust their pacing and approach, ensuring students keep up without cognitive overload. Encouraging self-directed learning empowers students to take charge of their progress, especially when classroom resources are limited. Lastly, fostering cooperation among teachers, parents, and policymakers will create a supportive environment that helps these educational reforms truly succeed.

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