Journal of Social, Humanity, and Education (JSHE)
ISSN2746-623X, Vol 3, No 2, 2023, 89-103 https://doi.org/10.35912/jshe.v3i2.1194

The spiral progression approach in teaching science: Its Volatilities, Uncertainties, Complexities, and Ambiguities (VUCA)

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Article History
Received on 28 July 2022
1st Revision on 4 August 2022
2nd Revision on 15 August 2022
3rd Revision on 22 August 2022
4th Revision on 24 August 2022
5th Revision on 7 September 2022
Accepted on 8 September 2022

Abstract
Purpose: The purpose of the study is to assess the implementation of the spiral progression approach in teaching science according to the threat of its volatility, uncertainty, complexity, and ambiguity (vuca).
Methodology of Research: Descriptive research design was employed in this study, and the total enumeration technique was used to determine the respondents. A valid and reliable self-made questionnaire was utilized in the conduct of the study.
Results: As viewed in the result of the study, it was found that the VUCA level of the spiral progression approach in teaching science is Low, therefore there is a minimal threat and issues that need to be addressed properly since if ignored, it will pose a bigger problem in the future. Likewise, the implementation of the spiral progression approach in science teaching is geared toward the right track.
Limitations: This study looks into the implementation of the spiral progression approach and assesses its volatilities, uncertainties, complexities, and ambiguities (VUCA) as a way to cope with its complex conditions as perceived by science teachers and serves as variables of the study. Respondents of the study were limited only to those teachers teaching secondary science in the school year 2021-2022.
Contribution: This research endeavor will be beneficial as it aims to add knowledge on the implementation of the Spiral Progression Approach with a special focus on its volatility, uncertainty, complexity, and ambiguity which will become the basis of future programs and policies to illuminate the current set of understanding about this educational reform program.
Keywords: *VUCA, Spiral Progression Approach, Science Teachers, Science Teaching*
How to Cite: Baron, J. V., & Cruz, J. A. D. (2023). The spiral progression approach in teaching science: Its Volatilities, Uncertainties, Complexities, and Ambiguities (VUCA). *Journal of Social, Humanity, and Education,* 3(2), 89-103.

1. Introduction

The Philippine education system went through several stages of development before reaching the current education system. For a long time, the Philippine government has been working hard to improve education programs to satisfy all Filipinos with quality education. The goal of improving the education system provides the appropriate tools to achieve national goals that can be attained through appropriate reforms in educational programs.

The professional world of education has been considered a changing era and the needs of the students have been the utmost focus of adapting to changes in the educational curriculum (Sharma et al., 2019). As such, one of the major changes in Philippine education history to ameliorate the quality of education was the implementation of K to12 reform through Republic Act 10533 also known as the Enhanced Basic Education Act of 2013.

Since the curriculum is considered to be the heart of the educational system. Therefore, Republic Act 10533 ensures that the overall curriculum design for Grades 1-10 follows a spiral progressive approach between subjects based on the same concepts developed with increasing complexity and completion from primary school onwards (Reyes & Dizon, 2015). Also, teachers are expected to use a spiral progression approach in teaching, and the development of topics in the subject lessons should be interrelated each year especially, in teaching Science.

In terms of existing literature, there is a scarcity of studies that combines education and VUCA the research is trying to fill the gap. Consequently, assessing the spiral progression approach by determining its volatility, uncertainty, complexity, and ambiguity provide a better understanding of its future effect particularly on students' mastery that instead of progressing upward it may be a downward spiral considering the increasing level of difficulty, new learning is related to previous learning and competencies of students are expected to increase (Harden & Stamper, 1999) since VUCA provides an opportunity to examine whether spiral progression approach of the curriculum served its purpose and content. Hence, it is imperative to look into the implementation and potholes of the spiral progression approach as a way to create an approach the solution to cope with complex conditions and the problems of its volatility, uncertainty, complexity, and ambiguity (VUCA) for planning to take on a different approach of advantages like moving from volatility to vision, from uncertainty to understanding, from complexity to clarity and ambiguity to agility or adaptability.

For students and teachers alike to be of a greater level of understanding, more clarity, and the ability to be agile and adapt to the new approach in the curriculum using the spiral progression approach, it is with the utmost necessity to look into the level of implementation, hand in hand, assessment of its volatility, uncertainty, complexity, and ambiguity as perceived by Science teachers in the division of General Santos City, the school year 2021- 2022.

1.1 Research questions

This study intends to answer the following research questions:

1. What is the assessment level of the spiral progression approach of K to 12 as perceived by science teachers based on its volatilities, uncertainties, complexities, and ambiguities?
2. What is the level of implementation of the spiral progression approach of K to 12 among Science teachers in terms of learning objectives and learning competencies?

1.2 Objectives of the Study

The study on the implementation of the spiral progression approach in teaching science and its volatilities, uncertainties, complexities, and ambiguities as perceived by science teachers in the division of General Santos City, the school year 2021-2022 intended to:

1. Evaluate the level of implementation of the K to 12 spiral progression approach.
2. Investigate the level of the volatilities, uncertainties, complexities, and ambiguities of the spiral progression approach, specifically in teaching science.

2. Literature review and hypothesis development

2.1 Spiral Progression Approach

Spiral Progression Approach in curriculum comes from Bruner's spiral curriculum model (de Ramos-Samala, 2018). Bruner emphasized that education should always aim to stimulate cognitive development. Students will not understand a concept if the teacher plans to teach it using only the teacher's level of understanding. Programs should be arranged in a spiral so that the student is continually building on what he or she has learned. Consistent with other findings, Bruner views the teacher's role as translating information into a format appropriate to each child's current state of understanding (Igcasama, 2021). Hilda Taba also influences the design of a spiral curriculum that is organized around concepts, skills, or values in the horizontal integration of learning (Davis, 2007).

Based on the arguments put forward, the effectiveness of the curriculum depends on the teacher's knowledge of the curriculum, its teaching strategies, and mastery of the subject (Duze, 2012).

The idea of the spiral progression approach is to expose students to various concepts and/or topics and disciplines until they master them by studying them over and over again, but at different depths. Regarding the high school science curriculum, it consists of four fields: integrated science, biology, chemistry, and physics. In the old curriculum, integrated science was taught in the first year, the second year of biology, the third year of chemistry, and the fourth year of physics (Raguindin, 2020). However, in the high school science curriculum which was only implemented in 2012, the concepts of these four main areas are taught simultaneously. Each year, students are exposed to a spiral developmental approach, in which all four areas are taught with assessment periods. In addition, integrated science has been transformed into earth science.

Many problems in life involve scientific explanations and processes. For this reason, understanding science and a scientific approach are very important for making smart decisions (Resurreccion & Adanza, 2015). In this regard, Science subjects diverge into separate disciplines in secondary education. Thus, there is a need for teachers with sufficient knowledge in all these areas.

2.2 Spiral Progression Approach in the Philippine Context

The Enhanced Basic Education Act of 2013, made legal by R.A. No. 10533 brought a lot of innovations. Among the different disciplines, Science is one of the subjects which has undergone major revisions. As stated in the Standards and Principles under Curriculum (R.A. No. 10533, Rule II Section 10.2g), the curriculum shall use a spiral progression approach to ensure the mastery of the subject. This ensures that the learning competencies were decongested and the same fields shall be taught but with increasing complexity and sophistication (Valin and Janer, 2018).

The days the Philippine education had general science in science 7, biology in science 8, chemistry in science 9, and physics in science 10 had been long gone (Sanchez et al., 2014). This is due to the shifting of the new curriculum as mandated in the Republic Act No. 10533 which aims to put an end to the congestion of the Philippine basic education curriculum. Before the introduction of this enhanced curriculum, the Basic Education Curriculum (2002) and Secondary Education Curriculum (2010) were described as too congested and equipped with numerous knowledge and skills for the learners to be learned for a limited time (Gonzales, 2019). Moreover, students' failure to learn the competencies essential for life skills were the drawbacks of fragmented and disintegrated learning based on the framework of the former curriculum (Orbe, Espinosa, and Datukan, 2018).

Science teaching's spiral progression brought different reactions to some. Before the K to 12, science subjects have linear progression where each year level is specialized and focused on a single field of Science (Gonzales, 2019). This offers an avenue for seasoned teachers to teach better because of their field of specialization (Cabansag, 2014). Though the implementation of spiral progression brought positive opinions from other teachers, some who are more focused on their specialization prefer to have ample time preparing for the activities they have long mastered compared to the ones they have just learned from supplementary training conducted by the Department of Education.

It is revealed that the understanding of teachers toward the spiral progression approach revolves around the concept of vertical and horizontal articulation of the curriculum (de Ramos-Samala, 2018). Data from her study showed that the majority of the teachers have the same thought that both vertical and horizontal articulation of the Spiral Progression Approach is very hard to trace in the learning competencies. The reason lies in the diversity of the learners. Students with varying levels of understanding tend to have difficulty remembering the previous lesson forcing the teacher to review first before the start of the new lesson.

Though every teacher believes that the spiral progression approach simply follows the idea that learning flows smoothly when it is vertically aligned and having prior knowledge will easily open a bigger chance to develop a more complex idea. However, students in a higher grade level have difficulty connecting more complex topics like chemistry and physics since not all students can remember past lessons (Tapang, 2012). Moreover, the difficulty of remembering was one of the effects of the gap between the same principle in the different year levels. After tackling a specific field of Science in the first quarter, as proposed in the spiral progression approach curriculum, the next quarter will discuss another field of science, another in the next quarter, and so on. This pattern brought gaps in the learning continuity of the students and is believed to be the cause of students' difficulty connecting their previous learning with the new one.

2.3 Volatility, Uncertainty, Complexity, and Ambiguity (VUCA) in Education

The term VUCA originated from the United States Military in the late 1990s as a way of assessing the conditions brought about by the cold war (Bhattacharyya, Trehan, and Kaur 2018). Furthermore, as termed as a "panacea" of all sorts of situations in business and organizations where there's a need to understand the internal obstruction, plan, and execute accordingly, this concept has been considered in education as a relevant framework for research and an effective education system. VUCA stands for "Volatility, Uncertainty, Complexity, and Ambiguity". This four-quadrant framework has been a trend in business organizations in dealing with futuristic decisions by making sure that all the possible situations whether they are in the past or things yet to happen have been considered and assessed.

The introduction of the Spiral Progression Approach was one of the government's ameliorative efforts to cope with the pace of how students learn inside the classroom and pave the way to incorporate technological advancement. All these metamorphose are just a response to the world where education needs to agilely respond to threats and opportunities (LeBlanc, 2018). As the curriculum shifted from a conventional to a spiral progression approach, considering the drawbacks and downsides is very vital as the program progresses. This study covers the VUCAs of the spiral progression approach.

Volatility is the nature and dynamics of change or it refers to the speed of change in the world in general. The Philippine educational system evolved a lot, from its oldest name Superior Commission of Primary Instruction which was legalized by the Educational decree of 1863 to the 2001's Department of Education with legal order RA 9155 of Governance of Basic Education Act (Bodenhausen & Peery, 2009). Furthermore, the volatilities of the education world have made these changes and the shift from the old to the new curriculum has placed stress on the educational system to a broad extent, ranging from the continuous change in the medium of instructions, curriculum, frameworks, models, necessary strategies, instructional materials and involvement of the administration (Redelinghuis, 2012).

The rise of a certain curriculum aims to address the existing problems and prepares for future challenges. The current Spiral Progression Approach of K-12 covers all the weak points of its older versions – the BEC and DECS (Urlanda, 2018). Though no predestined curriculum ensures its effectiveness, in the end, utilizing all the factors present and devising a framework that would address the probable grey areas are the least that the educational system can do (Seymour, 2017).

On the other hand, uncertainty refers to the incapability of someone or a group of people to understand what is going on (Kraaijenbrink, 2018). It describes the unpredictability of a certain event that would happen or be associated with the future. In the present curriculum mandated by RA 10533, the sole focus of the shift of paradigm is to produce learners who are locally and globally competitive.

The implementation of this new curriculum gained several reactions from some, especially from teachers. Some do not agree that the shift was timely and some pointed out that frequent changes in curriculum just brought vagueness and difficulty both to teachers and to students (Cabansag, 2014). The planned learning activities, the delivery mode of instruction with the use of technology, the intricacy of lessons, the availability of instructional materials, modules, least mastered competencies, teachers' field of specialization, lesson gaps, and vertical articulations are just some of the complexities brought by the Spiral Progression Approach of K-12 Curriculum.

Complexity is the number of considerations that one needs to consider, their variety, and the relationships between them. Variety is affected by the factors involved which are interconnected. The more connections, the more complex environment is particularly in place (Kraaijenbrink, 2018).

Teaching materials refer to the resources used by the teacher to deliver instruction with ease and greater effectiveness. These materials aid students' learning and secure an increase in scholastic achievement (Basilan, 2018). The vast collection of teaching materials aims to guide both teachers and learners in teaching-learning instruction and to support teachers and students in the teaching-learning process.

Ambiguity refers to a lack of clarity on how to interpret something based on incomplete, contradictory, or inaccurate information; more generally refers to the vagueness and ambiguity of ideas and terminology (Bennett and Lemoine 2014). Furthermore, the presence of instructional materials reinforces the extent of learning the depth and implements tangible material for assessment and evaluation. They are developed to help the teachers facilitate learners' prior knowledge, assist them to process and understand the new learning, and eventually aid them to apply newly acquired knowledge to their practical lives (Smith, 2010).

It is reiterated that as teachers are now called facilitators and distributors of learning, the demand to practice effective facilitation techniques and skills in the proliferation of the K-12 curriculum is inevitable (Basilan, 2018). The need to provide instructional materials which are suited for generation x learners is to be considered. As practiced, the conventional learning process simply refers to face-to-face learning instruction inside the four-walled classroom where all exercises are to be facilitated by the teachers and learning will not happen in the absence of a teacher. Today, education and training have taken on a whole new meaning (Matzen & Edmunds, 2007).

3. Research methodology

3.1 Locale of the Study

The study on the volatilities, uncertainties, complexities and ambiguities (VUCA) of the spiral progression approach in the context of Science teaching was conducted in three (3) public secondary schools in Buayan District, Division of General Santos City namely; Buayan National High School, Johnny Ang National High School, and Ligaya High School. For a clearer view of the locale of the study, the location map is presented in Figure 1.

Figure 1. Location Map of Buayan District, General Santos City Division

3.2 Methods and materials

This study used a descriptive design of research. Since it is descriptive it will provide a detailed discussion to provide a comprehensive understanding of the phenomenon under investigation. To obtain the necessary data for the study, valid and reliable self-made questionnaires were used in the study to gauge the extent level of the implementation of the spiral progression approach and the level of its volatilities, uncertainties, complexities, and ambiguities.

3.3 Respondents of the study
Sixty (60) secondary teachers teaching Science in three (3) secondary schools in Buayan District in the division of General Santos City served as the respondents of the study.

3.4 Sampling technique
Since the study was comprised of small population size, the total enumeration technique was applied which constituted the entire population of Science teacher respondents.

3.5 Research instrument
The study was carried out using self-made questionnaires that were further validated by experts in the field of curriculum and instruction. The provided instruments were tested on a reliability platform with a Cronbach's alpha of *0.7407* indicating that the instruments were considered reliable and acceptable.

The survey questionnaires were composed of two parts, Part I focused on the assessment level of the Spiral Progression Approach of K to 12 as perceived by Science teachers comprising four (4) indicators namely: volatilities, uncertainties, complexities, and ambiguities. Part II survey questionnaire gauged the level of the implementation of the Spiral Progression Approach for K to 12 among Science teachers based on learning objectives and learning competencies.

3.6 Data gathering procedure
After receiving consent from the administrators of the participating schools, the survey questionnaire was distributed to participants. The questionnaires were administered by the researcher, who also provided instructions on how to complete them. Additionally, the nature and goal of the study were described. The respondents' completed questionnaires were obtained by the researcher right away for statistical analysis.

The researcher ensures that the data gathered were treated with utmost confidentiality as a means to protect the privacy of all teacher respondents and the informants in the Buayan District of General Santos City division.

3.7 Statistical treatment
To determine the assessment level of the spiral progression approach of K to 12 as perceived by science teachers based on its volatilities, uncertainties, complexities, and ambiguities (vuca) a mean was used. To determine the level of implementation of the spiral progression approach of K to 12 among Science teachers in terms of learning objectives and learning competencies, mean was also used.

4. Results and discussions

Research Question 1: What is the assessment level of the spiral progression approach of K to 12 as perceived by science teachers based on its volatilities, uncertainties, complexities, and ambiguities (vuca)?

The Volatilities of the Spiral Progression Approach
The ease and speed with which a situation might alter are referred to as volatility. In education, volatility is evident as learning is completely changed from one moment to the other and there is no control over anything. Likewise, science education especially in its methods, as well as approaches and themes, are continually evolving. Therefore, volatility is inevitable.

The necessary adjustments must be cultural: teachers must be provided with the necessary materials for teaching science, given moderate durations of time to teach for effectiveness, and made comfortable. To foster learning settings, tools and technologies must be developed (Downie and

McCartney, 2013). Additionally, in the twenty-first century, there is also the issue of confusion about the optimal procedures to use. As a result, science teachers' teaching methods must reflect the balance of teaching abilities and scientific knowledge required to educate and excite students, as well as the needs of individual students and the wider group. Apropos of the statement, Table 1 below shows the extent level of volatilities of the spiral progression approach in teaching science.

Table 1. Level of Volatilities of the Spiral Progression Approach in Teaching Science

Volatilities	Mean	Description	Interpretation
1) …differentiated instruction is not used for the evaluation and preparation of interactive activities that will cater to all types of learners.	1.61	Often	Moderate Volatility
2) …all concepts are not allotted the same amount of time whether they are easy or difficult to master.	1.13	Sometimes	Low Volatility
3) …it is difficult in sequencing instruction to ensure that students acquire necessary pre-skills before introducing difficult skills.	1.16	Sometimes	Low Volatility
4) …included topics are not appropriate to students' development/cognitive stages.	1.23	Sometimes	Low Volatility
5) …learners' retention and mastery of topics and skills are not strengthened as they are revisited and consolidated.	1.42	Sometimes	Low Volatility
6. …teaching environment is not equipped with necessary materials.	1.81	Often	Moderate Volatility
7. …the method of teaching does not reflect the balance between teaching skills and science knowledge.	1.23	Sometimes	Low Volatility
8. …teaching approaches are not specific for a particular group of learners.	1.58	Often	Moderate Volatility
Mean	**1.40**	**Sometimes**	**Low Volatilities**

As evaluated by teacher respondents as shown in the table above, the overall level of volatilities of the spiral progression approach of teaching science has a mean of *1.40* indicating that there is a low level of volatility in teaching science. Results also showed that all concepts sometimes are not allotted the same amount of time whether they are easy or difficult to master with a mean of 1.13, and sometimes are difficult in sequencing instruction to ensure that students acquire necessary pre-skills before introducing difficult skills. ($\bar{x}$= *1.16*), as well, teachers sometimes not included topics that are appropriate to students' development/ cognitive stages ($\bar{x}$= *1.23*), and the method of teaching sometimes does not reflect the balance between teaching skills and science knowledge ($\bar{x}$= *1.23*). As such, resulted to learners sometimes do not retain and master the topics and skills as they are revisited and consolidated with a mean of *1.42*. Further, results indicate that the criteria mentioned have no greater risk of affecting the effectiveness of the spiral progression approach to enhance learning (Laukkonen, Biddel, and Gallagher, 2019) since it offers lower stress in an unpredictable environment.

Although the overall mean shows a very low level of volatility in the implementation of the spiral progression approach in teaching science, some criteria manifest a moderate level of volatility, if not addressed, may result in a larger problem in the implementation of the spiral progression approach of the K to 12 programs of the Department of Education, more especially, in the science curriculum. As viewed on the result, differentiated instruction is often not being used for the evaluation and preparation of interactive activities that will cater to all types of learners with a mean of *1.61*, and often the teaching approaches are not specific for a particular group of learners ($\bar{x}$= *1.58*).

Indeed, the bulk of teacher ancillary works combined with the highly dense student population per classroom hinders the use of differentiated instruction, since the kind of teaching strategy needs more time of conceptualizing and learning the need of every student, and the use of spiral progression requires heavy preparation since every teacher must learn and teach the four science subject areas because it goes into spiral approach.

The result states that the biggest challenges facing teachers in the use of differentiated instruction strategies are related to the school environment such as the density of students per classroom and the overload of administrative responsibilities assigned to the teacher. The number of learners inside the classroom may affect the use of differentiated instruction since the strategy requires digging into the learner profile (Aldossari, 2018). However, due to the massive paperwork, that teacher nowadays faces, knowing every student's needs is only the secondary responsibility of the teacher and the main priority is the abrupt submission of all school forms.

Additionally, the lack of available educational equipment and instruments to apply the differentiated instruction strategy, especially in teaching science is also another factor to consider. Since, teaching science deals with the scientific investigation in gathering factual evidence hence equipment and instruments are a vital part of the methodology of science teaching (Tsybulsky, Dodick, and Camhi, 2018).

The aforementioned moderate volatilities are one of the challenges of teachers in the implementation of the spiral progression approach that needs important focus to be resolved if not this may impact the expected output the spiral progression provides. Furthermore, studies showed that the quality of output was best in schools having laboratories which are critical variables in determining the quality of output in schools. Laboratory and science equipment has a significant relationship with the performance of the students. Sufficient laboratories and materials are necessary to facilitate learning (Adeyemi, 2008).

By understanding the risks that may trigger the volatility of the implementation of the spiral progression approach in teaching science, one must also understand its complex relationship to the uncertainty of the spiral progression for uncertainty often occurs in volatile environments (Vincent, et al., 2019).

The Uncertainties of the Spiral Progression Approach

Uncertainty is the quality of information one has or the degree to which the outcome of an event or any program is knowable in advance. It also pertains to individuals' level of trust in their ability to foresee the future (Nandram & Bindlish, 2017) define. In education, uncertainty may include the confusion of teachers' incapacity to comprehend what is happening in reality (Bennett & Lemoine 2014). Table 2 shows the level of uncertainties of the spiral progression approach in teaching science as perceived by public secondary teachers.

As presented in Table 2 the lack of understanding that accompanies unforeseen events is referred to as uncertainty. Science teaching is ambiguous for science teachers, who are never sure what their students grasp, whether the misunderstandings are due to insufficient content or a lack of understanding of difficult topics. There is also a lot of doubt regarding how teachers may enhance their classroom practices because no one knows which teaching strategies and integration will work best with a specific group of students. As such, teaching strategies play part in the uncertainty of using the spiral progression approach in teaching, and from the data obtained as shown in Table 2, there is something that needs to be addressed properly.

As evident in the responses of the teachers with a mean of *1.25*, indicates that uncertainties of the implementation of the spiral progression approach are often manifest. The mean of *1.25* further explains that there is a low level of uncertainty in the spiral progression approach in science teaching. Moreover, as viewed the result, shows that in the implementation of the spiral progression approach the competencies are often not set out as growth opportunities to learn, unlearn and relearn concepts in science ($\bar{x}$= *1.03*), and the program often does not strengthen retention as competencies are paired with specific performance task ($\bar{x}$= *1.06*), the program often is not arranged or associated topics with a mean of *1.09*.

Also, it is apparent that in spiral progression the completed units often do not offer sufficient review in mastering a topic ($\bar{x}$= *1.09*), as well as, the contents are often not adequate to prevent misunderstanding ($\bar{x}$= $\bar{x}$= *1.22*), and the program is often not future-proof as competencies are non-negotiable ($\bar{x}$= *1.34*).

Table 2. Level of Uncertainties of the Spiral Progression Approach in Teaching Science

Uncertainties	Mean	Description	Interpretation
1) …the program is not future-proof as competencies are non-negotiable.	1.34	Sometimes	Low Uncertainty
2) …the program does not strengthen retention as competencies are paired with a specific performance task.	1.06	Sometimes	Low Uncertainty
3) …performance tasks provide are not valid experiences.	1.50	Sometimes	Low Uncertainty
4) …completed units offered are not sufficient to review in mastering a topic.	1.12	Sometimes	Low Uncertainty
5) …the program has not arranged or associated topics.	1.09	Sometimes	Low Uncertainty
6) …competencies hinder growth opportunities to learn, unlearn and relearn concepts.	1.03	Sometimes	Low Uncertainty
7) …contents are not adequate to prevent misunderstanding.	1.22	Sometimes	Low Uncertainty
8) …the integration of educational technology is not enough to hone students' basic skills in science.	1.66	Often	Moderate Uncertainty
Mean	**1.25**	**Sometimes**	**Low Uncertainties**

Although most of the criteria are often manifested, there is one criterion that poses a moderate level of uncertainty which yields a mean of *1.66*. The result explains that the integration of educational technology is sometimes not enough to hone students' basic skills in science.

The Complexities of the Spiral Progression Approach in Teaching Science

Complexity refers to the fact that a situation and/or condition is affected by multiple factors that interact with each other which can lead to an experience of chaos and stress (Bennett & Lemoine, 2014). Since the spiral progression approach avoids gaps in learning, it allows students to study topics and skills that are appropriate for their developmental and cognitive stages, and it reinforces retention and mastery of those topics and skills as they are reviewed and consolidated. But, the complexity of spiral progression is the difficulty of sequence training to ensure that students gain sufficient pre-skills before introducing a difficult skill posed a great challenge in the use of spiral progression (Resurreccion & Adanza, 2015).

For a better understanding of the complexity of the spiral progression approach in teaching science, Table 3 presented the data as shown on the succeeding page. The data provided in Table 3, shows that the level of complexity of the spiral progression approach as viewed by science teachers is low with an average mean of *1.20*.

The average mean of *1.20* with a description. Often, interpreted as low complexities of the spiral progression approach, particularly in teaching science entails that despite the diverse elements of the said spiral progression, science teachers were able to relate each element with clarity. As such, results elucidated that there is a low risk in the implementation of spiral progression in terms of its complexity.

Further, the study revealed that the integrative and multidisciplinary approaches which enable learners to connect disciplines are often not integrated ($\bar{x}$= *1.53*). Students also often do not have the chance to apply and develop their skills and understanding in increasingly challenging situations ($\bar{x}$= *1.37*) (see Table 3).

Table 3. Level of Complexities of the Spiral Progression Approach in Teaching Science

Complexities	Mean	Description	Interpretation
1) …the progression of learning competencies of Science does not cater to learners' needs for a particular period.	1.09	Sometimes	Low Complexity
2) … the continuity of lessons in all grade levels does not provide a concrete link between concepts.	1.09	Sometimes	Low Complexity
3) …the topics discussed in the previous years are not needed in the present year.	1.09	Sometimes	Low Complexity
4. …the lessons are not easy to understand since there are no interconnected topics at varying levels of complexity.	1.22	Sometimes	Low Complexity
5) …the gap between connected topics is not too short to recall the details of the previous lesson.	1.28	Sometimes	Low Complexity
6) …students do not have the chance to apply and develop their skills and understanding in an increasingly challenging situation.	1.37	Sometimes	Low Complexity
7) … no integrative and multidisciplinary approach enables learners to connect disciplines.	1.53	Sometimes	Low Complexity
8) …the progression of concept does not structure experiences and sufficient challenge in a recognizable curricular landscape.	1.00	Sometimes	Low Complexity
Mean	**1.20**	**Sometimes**	**Low Complexities**

It is also evident that the gap between connected topics is not often too short to recall the details of the previous lesson ($\bar{x}$= *1.28*) and lessons are not often easy to understand since there are interconnected topics at varying levels of complexity ($\bar{x}$= *1.22*).

Additionally, the study showed that the progression of learning competencies of science often does not cater to learners' needs for a particular period ($\bar{x}$= *1.09*). Also, the continuity of lessons in all grade levels often does not provides a concrete link between concepts, and the topics discussed in the previous years are not often needed in the present year ($\bar{x}$= *1.09*), and the progression of concepts does not often structures experiences and sufficient challenges in a recognizable curricular landscape ($\bar{x}$= *1.00*).

The Ambiguities of the Spiral Progression Approach in Teaching Science

One important element of the K-12 curriculum is the decongestion of the competencies and arrangement where science concepts and applications in all subjects are given in a spiral progression (Orbe, Espinosa, and Datukan, 2018). However, it is inevitable to note that spiral progression itself has its ambiguity. Therefore, this section will discuss the ambiguities of the spiral progression approach in science teaching as viewed in Table 4 below.

As reflected in Table 4, most teachers agreed that the presentations of the lessons are often broadened and deepened each time a concept is revisited and often provide relevance and real-world experience to create stronger connections to the content that is to be covered ($\bar{x}$= *1.00*). It is also evident that often there is a fixed assessment method to gather authentic learning from students ($\bar{x}$= *1.03*) and that the lessons are often extended in a more elaborate and comprehensive teaching style ($\bar{x}$= *1.06*).

Added to the result shown in Table 4, shows that students often do not learn the subject matter at their phase ($\bar{x}$= *1.12*) and that the lessons are not presented starting from abstract rather than a concrete construct of domains ($\bar{x}$= *1.19*) which often teaching strategies do not help learners appreciate the connections among the different content standards ($\bar{x}$= *1.47*).

Table 4. Level of Ambiguity of the Spiral Progression Approach in Teaching Science

Ambiguity	Mean	Description	Interpretation
1) …it does not provide relevance and real-world experience to create stronger connections to the content that is to be covered.	1.00	Sometimes	Low Ambiguity
2) …there is no fixed assessment method to gather authentic learning from students.	1.03	Sometimes	Low Ambiguity
3) …the lessons are not extended in a more elaborate and comprehensive teaching style.	1.06	Sometimes	Low Ambiguity
4) …teaching strategies do not help learners appreciate the connections among the different content standards.	1.47	Sometimes	Low Ambiguity
5) …the presentations of the lessons are not broadened and deepened each time a concept is revisited.	1.00	Sometimes	Low Ambiguity
6) …students do not learn the subject matter in their phase.	1.12	Sometimes	Low Ambiguity
7) …teachers do not have expertise on all topics. Hence, allowed out-of-field teachers to teach Science.	1.75	Often	Moderate Ambiguity
8) …lessons are not presented starting from abstract rather than a concrete construct of domains.	1.19	Sometimes	Low Ambiguity
Mean	**1.20**	**Sometimes**	**Low Ambiguities**

From the data obtained as shown in Table 4, the overall mean of *1.20* indicates low ambiguity. Although, the level of ambiguity is characterized as low still there is a risk that may affect the implementation of spiral progression in the future. As such, it is better to understand such risks to mediate future negative instances. For instance, as reflected in Table 4, sometimes teachers are not expected to have expertise on all topics. Hence, allowing out-of-field teachers to teach Science yields a moderate ambiguity with a mean of *1.75*. By and all itself, this posed a great threat to the implementation of this approach.

The Overall Level of Volatility, Uncertainty, Complexity, and Ambiguity of the Spiral Progression Approach in Teaching Science

Table 5 below provides an overview of the volatility, uncertainty, complexity, and ambiguity of the spiral progression approach particularly in teaching science curriculum.

Table 5. The Overall Level of VUCA of the Spiral Progression Approach in Teaching Science

Level of VUCA of the Spiral Progression Approach in Teaching Science	Mean	Description	Interpretation
Volatility	1.40	Sometimes	Low Volatilities
Uncertainty	1.25	Sometimes	Low Uncertainties
Complexity	1.20	Sometimes	Low Complexities
Ambiguity	1.20	Sometimes	Low Ambiguities
Mean	**1.26**	**Sometimes**	**Low VUCA**

As evident from the table above, the spiral progression approach of the K to 12 of the Department of Education particularly, in teaching science curriculum is low with a mean average of *1.26*. The overall mean indicates that there is a lower risk of unforeseen factors, elements, and/or eventualities that will hinder or negatively affect the implementation of the said spiral progression in science toward uncontrollable and unpredictable forces.

Based upon the result, shows that ambiguity and complexity have a higher mean compared to the two elements with a mean of *1.20*. on the other hand, uncertainty gained a mean score of *1.25*, while volatility considers the lowest mean among the others with a mean of *1.40*. Therefore, in comparison, it is noted that volatility has a greater need of mitigating the unforeseen, unprotectable, and uncontrolled risk as provided by each incorporated criterion. As everyone would suggest, prevention is better than cure, hence early detection of the issues confronting the implementation of the SPA will provide a greater chance of success and achievement of the specific goals and objectives laid upon the application of the spiral progression approach. Hence, a world that is volatile, uncertain, complex, and ambiguous provides the ideal feeding ground for potential gain, strength, and success if mitigated well.

Research Question 2: What is the level of implementation of the spiral progression approach of K to 12 among Science teachers in terms of learning objectives and learning competencies?

The concept of the spiral progression approach is to revisit basic ideas, elaborating on them until the students have comprehended the entire formal concept. As learning advances, more and more specifics are introduced, but the basics are reemphasized and rediscovered numerous times, leading to mastery of the teachings in the Spiral Progression Approach (Corpuz, 2013). Therefore, looking into the level of the implementation of the spiral progression approach of the K to 12 is one of the paramount considerations of the study on areas of learning objectives and learning competencies. As such, the succeeding table shows the result.

Table 6. The Overall Level of Science Teachers' Implementation of Spiral Progression Approach of K to 12

Science Teachers' Implementation of Spiral Progression Approach of K to 12	Mean	Description
Learning Objectives	3.81	Often
Learning Competencies	4.30	Often
Mean	**4.05**	**Often**

As viewed in Table 6, the overall mean of 4.05 shows that the spiral progression approach of K to 12 was often implemented among science teachers this is because the curriculum guide where learning, objectives, competencies, and learning standards are already incorporated and defined provides the purpose to guide and to provide some general instructions and topics to school teachers and administrators of what is need to be achieved of every learner in a specific education program (Reyes & Dizon, 2015). Additionally, the curriculum guide not only integrates the learning competencies and learning objectives, but curriculum guide also focuses on a certain learning area or subject at a given educational level in a specific group of learners to direct teachers on approaches and processes for successful planning and implementation of the curriculum at school (Shkedi, 2009). As a result, the curriculum guide offers ideas, suggestions, and recommendations to assist teachers in making informed judgments, or it can be more prescriptive and thorough in describing the content, activities, tasks, and resources to be used. It is certain as seen in the previous table that the implementation of spiral progression is often implemented among science teachers and these teachers are often doing their best to adapt to this new curriculum approach to produce globally competitive, dynamic learners, and citizens as envisioned along with the implementation of spiral progression approach.

5. Conclusion

The passage of Republic Act No. 10533 or the Enhanced Basic Education Act of 2013 impelled that the curriculum shall use the spiral progression approach to ensure mastery of knowledge and skills after each level. As such, teachers are expected to use the spiral progression approach in teaching science. However, the world including all programs, approaches, and practices has a lot of risks brought about by unforeseen and unpredictable change.

Thence, the findings of the study led to the conclusion that the implementation of the spiral progression approach, especially, in teaching science is on track provided the challenges and threats of its volatility, uncertainty, complexity, and ambiguity (VUCA) should be addressed for every issue has its own set of causes and solutions, it is only important to seek to deal with it through an effective program implementation that will counter the future, unpredictable, and unforeseen threat.

5.1 Recommendations

Based on the findings and conclusions, these recommendations are hereby presented:

1. A teacher training program is proposed to better prepare and equip teachers in the execution of the Spiral Progression Approach in science teaching, more specifically, the integration of across curriculum/ multidisciplinary approach in teaching science.
2. The school particularly the school head must provide support and training and or programs for the teachers to enhance their ICT skills and/ or computer literacy skills. This training that every school should provide must be continuous so teachers may update whatever skills they possess in ICT, especially on the latest trend in information technology suitable for integration into the classroom setting.
3. Essential materials, equipment, and tools must be provided to cover the requirements and the smooth implementation of the spiral progression approach.
4. Future researchers may conduct similar studies on the assessment of the implementation of the spiral progression approach in the VUCA world in a wider scope and a more comprehensive variable.

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