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Teaching in the K12 Science Spiral Curriculum: An Experiential Approach

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This research is aimed to investigate the current implementation of the Science Spiral Curriculum from the perspective of the Science Teachers in the city of Baybay, Leyte. Descriptive-evaluative research design was used. This study was conducted in five selected Secondary High Schools in Baybay City Division. The respondents of this study were science teachers in the secondary level who must be a graduate of Bachelor of Secondary Education specializing in Science or any science subjects and are teaching Science subjects. The past and present experiences and also difficulties of Science Teachers in teaching Science subjects using the old curriculum and the new K to 12 Science curriculum in terms of the subject content were identified utilizing a researcher-made questionnaire checked and evaluated by experts. The comments, suggestions, or feedback regarding the Science spiral curriculum content was also included. Based on the results, science teachers have experienced difficulties teaching the Science spiral curriculum because of the misalignment of contents in the new science spiral curriculum. This study concludes that the past and present experiences and difficulties of science teachers in teaching using the new and old curriculum, guide the science teachers in choosing their preferred arrangement of the content of the Science curriculum.

Keywords: science spiral curriculum, science teachers, teachers' experiences, teachers' difficulties

INTRODUCTION

The Philippines educational system has recently shifted from the Basic Education Curriculum into the new Kindergarten to 12 Curriculum. Science is one of the K to 12 Curriculum subjects that have undergone major revisions (Montebon, 2014). In the Basic Education Curriculum, Science subjects were taught using a discipline-based approach wherein specific science subjects are taught at each level. In the new curriculum, Science is taught in a spiral progression approach. This study claims that the new science curriculum has a misalignment of contents that causes confusion among science teachers.

Curriculum refers to the lessons and academic content taught in a school or a specific course or program (Glossary of Education Reform, 2015). Since the Philippines has implemented a new curriculum, a new approach is used in teaching the subjects. This spiral progression approach means that the basic principles are introduced in the first grade and are rediscovered in the succeeding grades in more complex forms. With this approach, concepts are introduced at an early age and re-taught in succeeding years in an increasingly sophisticated fashion (Gatdula, 2016).

The K to 12 curriculum implementation triggered educators to conduct studies on the relevance and importance of the recent curriculum program. Dizon et al. (2019) concluded that teachers hoped that the implementation of the K to12 curriculum was a solution to the different issues in the country. Crisol and Alamillo (2014) found out that students' attitudes were positive to the implementation of the K to 12 programs, for they think it will be successful in achieving its goal. Montebon (2014) added that it affects the way they learn science concepts, acquire skills, and develop scientific attitudes and

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values, positively. Thus, the new science curriculum "gained a positive impact on students' performance" (Madkour, 2015).

Orbe, Espinosa and Datukan (2018) found out that spiral progression of the content, specifically in Chemistry, is viewed by teachers as learner-centered and steers holistic learning, which allows the students to update retained knowledge from grade 7 to grade 10. Since it is ladderized, each grade level receives a piece of each subject area, so updating is made easier. Students were given a jumpstart in Science as they entered high school for having all these subjects in every year, thus improving learning. Learning is extended, reinforced, and broadened each time a concept is revisited (Ferido, 2013).

Lujan (2021) stated that teachers are a fundamental factor in the quality of the educational process. Few studies focused on the teachers' perspective of the curriculum content as the science curriculum has changed. It has been established that teachers' feedback on the new science curriculum plays a significant role in the implementation of the new curriculum. Their active involvement in collaborative curriculum design can improve the harmonization of the formal and the enacted curriculum (Penuel, et al., 2009), contributing to the success of the curriculum implementation (Abudu & Mensah,2016) and their opinions and professional beliefs help in the teaching and learning process (Lujan, 2021).

The implementation of the new science curriculum leads to the discovery of some lapses and discrepancies, particularly of the distribution of topics, which is the main concern of teachers. Students' had hard time to relate the topics they learned from their previous level to their present topics (Bagtas et al., 2016). This is highly evident in the retention rate that each student reveals during the discussion of the new topic.

Another study stated that spiral progression of the contents is not concentrated, extensive, and challenges instruction although it is learner-centered, advanced, and sophisticated (Orbe, Espinosa & Datukan, 2018). They added that science teachers expressed disappointment of the spiral progression of one discipline of Science in the K to12 framework. The results reported that the curriculum is not spiral, opposite of what the documents state, and that knowledge learned from the previous grade does not serve as a pre-requisite for the succeeding lesson.

Based on the objectives, this study tried to investigate the current implementation of the Science Spiral Curriculum from the perspective of the Science Teachers. This will hopefully improve the implementation of the new Science curriculum. Thus, this study will also enable curriculum designers to reflect on the impacts of the content arrangement on every curriculum introduced.

Framework of the study

John Dewey believed that human beings learn through a 'hands-on' approach. This places Dewey in the educational philosophy of pragmatism (John Dewey on Education: Impact & Theory, 2014). Pragmatists believe that reality must be experienced. Neill (2005, as cited in Song & Kidd, 2010) states that John Dewey's Theory of Experience is that experience arises from the interaction of two principles -- continuity and interaction. Continuity is that each experience a person has will influence his/her future, for better or for worse. Interaction refers to the situational influence on one's experience.

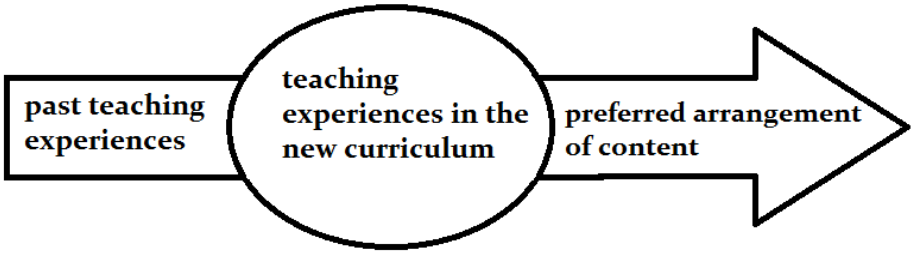

Figure 1
Conceptual framework of the study

This study uses ideas from Dewey's Theory of experience. In this theory, the value of the experience is to be judged by the effect that experience has on the individual's present, their future, and the extent to which the individual is able to contribute to society. Figure 1 shows the conceptual framework of this study which focuses on teaching experiences of science teachers. The past teaching experiences and the teaching experiences in the new curriculum will guide the science teachers in choosing their preferred arrangement of content of the new Science spiral curriculum.

METHOD

This study used descriptive-evaluative research design. Descriptive-evaluative research design is a design to appraise carefully the worthiness of the current project implementation (Paler-Calmorin & Calmorin, 2007). This study is a descriptive-evaluative research since the researcher wishes to conduct a study on the evaluation of an implementation of the new Kto12 Science Spiral curriculum.

This was conducted in five selected Secondary High Schools in Baybay City Division. These schools are selected for they have more population than other secondary schools in the division. The schools selected are Baybay City National High School, Bitanhuan National High School, Bunga National High School, Caridad National High School and Plaridel National High School.

The respondents of this study were science teachers in the secondary level under Baybay City Division. Teachers must be a graduate of Bachelor of Secondary Education specializing Science or any science subjects and are teaching Science subjects. Purposive sampling was used in selecting the schools and in selecting the respondents from each school.

Table 1
Distribution of respondents

Schools	Teachers	
	Frequency	%
Baybay National High School	5	26.32
Bitanhuan National High School	4	21.05
Bunga National High School	4	21.05
Caridad National High School	2	10.53
Plaridel National High School	4	21.05
TOTAL	19	100

This study utilized a researcher made questionnaire which was checked and evaluated by a Master's Degree or Doctor's Degree in Science or any related field. Once validated, the questionnaire was ready to use. The instrument consists of four parts. Part 1 of the questionnaire collects the profile of the respondents. Part II identifies information of science teachers' past and present teaching experiences in teaching science using the old curriculum and new curriculum, respectively. It consists

of 10 statements about curriculum content and respondents will check either agree or disagree if it is applicable in the two curriculums.

Part III identifies information of science teachers' past and present teaching difficulties in teaching science using the old curriculum and new curriculum, respectively. It also consists of 10 statements about some of the difficulties teachers' faced in teaching the two curriculums. The respondents will check either agree or disagree if it is applicable in the two curriculums.

Part IV inquires the science teachers' comments, suggestions or feedback with regards to the content of the Science Spiral Curriculum from Grade 7 to Grade 10. It presents a table with corresponding contents from Grade 7–10. Respondents may write comments/suggestions on the right side of the table.

A permit to conduct the study was addressed to the Supervisor of Baybay City Division office (BCDO). Upon the approval of the letter, the study was conducted. The researcher went to the selected schools on the month of October 2018 and asked permission from their respective principals to conduct the study.

The respondents of this study were only the Science teachers. The science teachers were oriented of the study and were given direction in answering the questionnaire. The respondents were reminded to answer the questionnaire honestly for authentic data. The data gathered was recorded and tabulated for analysis.

The data gathered were presented in tables and figures which served as basis for the discussion. In analyzing the data, the statistical technique employed was frequency counts. The data gathered through questionnaires were analyzed and interpreted from various angles. The data from the Part IV of the questionnaire was analyzed qualitatively.

FINDINGS

Table 2
Frequency count of science teachers' experiences

Experiences __ Statements	Using old curriculum (Discipline-based)		Using K12 curriculum (Spiral Progression)	
	Agree	Disagree	Agree	Disagree
1. Contents are fairly distributed in depth and breadth of the particular discipline.	19	0	8	11
2. Each level of subject matter is smoothly connected to the next.	17	2	7	12
3. There are no glaring gaps or wasteful overlaps in the subject matter.	19	0	7	12
4. There is logical arrangement of the subject matter or content.	17	2	10	9
5. There is continuity which means constant repetition, review and reinforcement of learning.	16	3	11	8
6. Usefulness of content is relative to the learner who is going to use it.	18	1	17	2
7. Subject matter is within range of the experiences of the learners.	17	2	12	7
8. Content is within the context of the existing reality in schools, in society and government.	18	1	14	5
9. Knowledge learned from the previous lesson serves as pre-requisite for the succeeding lesson.	15	4	12	7
10. The content is significant which means it is selected and organized for the development of learning activities, skills and attitudes.	17	2	13	6

The table above contains statements about teachers' experiences on the content of the two curriculums. Descriptive analysis shows that most of the science teachers agreed that they had experienced these statements when they taught using the old curriculum than when they use the new K12 curriculum.

Of the 19 science teachers who qualified as respondents in the Baybay City Division, more than 70% agreed that they have experienced all these statements on curriculum content when they taught using the old curriculum. In the case of using the new k12 curriculum, most of the statements got more than 60% agreed by the science teachers.

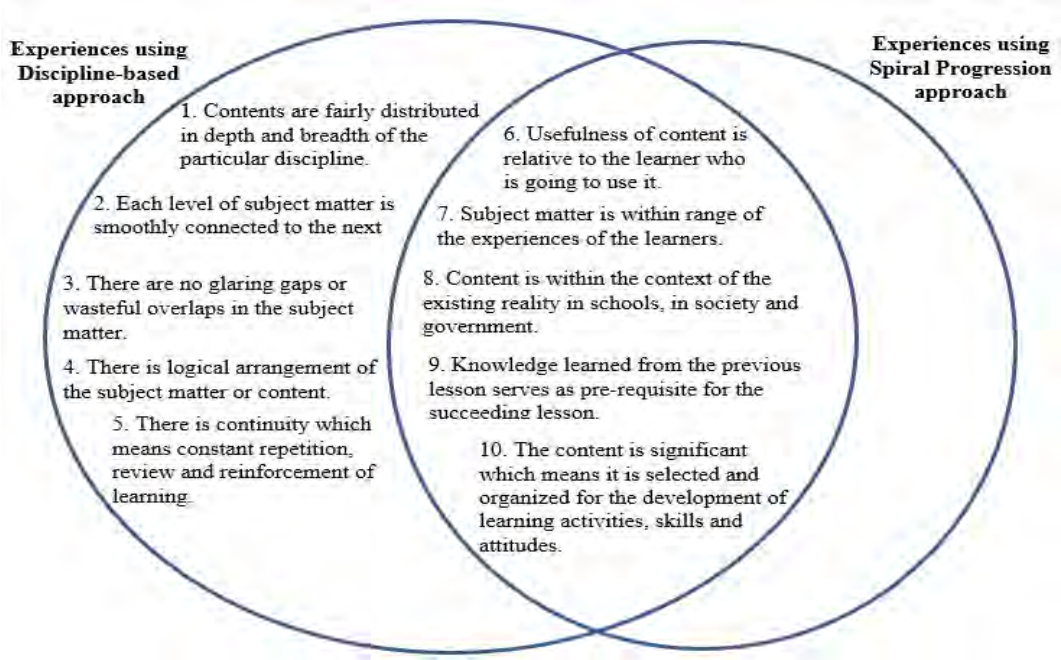

Figure 2
Vein diagram of science teacher's experiences

Science teacher's experiences in both curriculums can be compared using the vein diagram. Figure 2 above shows the statements that can be found either in discipline-based approach or in spiral progression approach or in both of them. Descriptive analysis shows that there are no new ideas that can be found in the new k12 curriculum.

Out of 10 statements for curriculum content, 50% of the statements can be found in the discipline-based approach while the other 50% can be found in both of them. Results show that no statements can only be found for the spiral progression approach.

Table 3
Frequency count of science teachers' difficulties

Difficulties __ Statements	Using old curriculum (Discipline-based)		Using K12 curriculum (Spiral Progression)	
	Agree	Disagree	Agree	Disagree
1. Many topics are covered but are taught only briefly wherein many students fail to master important concepts.	3	16	16	3
2. It is difficult to teach when some contents are not arranged accordingly.	5	14	16	3
3. I observed that it is difficult for the students to connect their previous lesson to the next one because some level of subject matter is not smoothly connected to the next.	4	15	16	3
4. I find it time consuming since I have to reteach first the prerequisites before we can teach the intended lesson because most students forget it already.	1	18	19	0
5. I find it difficult in teaching a specific discipline because there is no logical arrangement of content.	2	17	16	3
6. I observed that some of the knowledge learned from the previous lesson does not serve as pre-requisite for the succeeding lesson.	4	15	12	7
7. I find it difficult to teach since all concepts are allotted the same amount of time whether they are easy or difficult to master.	3	16	17	2
8. I observed that the learning and teaching methods does not encouraged participation.	1	18	5	14
9. The content standard allotted per year level is limited and is problematic since the subject is changing quarterly, focus is very minimal, lacks depth, and lacks concentration.	3	16	18	1
10. There is no continuity of contents since there is no constant repetition, review and reinforcement of learning.	5	14	14	5

The table above contains statements about teachers' difficulties on teaching using the two curriculums. Descriptive analysis shows that most of the science teachers disagreed that they did not experienced these difficulties when they taught using the old curriculum but they agreed that they have these difficulties when they taught using the new k12 curriculum.

Of the 19 science teachers who qualified as respondents in the Baybay City Division, more than 70% disagreed that they have difficulties in teaching when they taught using the old curriculum. This is opposite in the case of using the new k12 curriculum wherein most of the difficulties got more than 60% agreed by the science teachers which means that they had these difficulties in teaching using the k12 curriculum.

Science Teachers' Difficulties

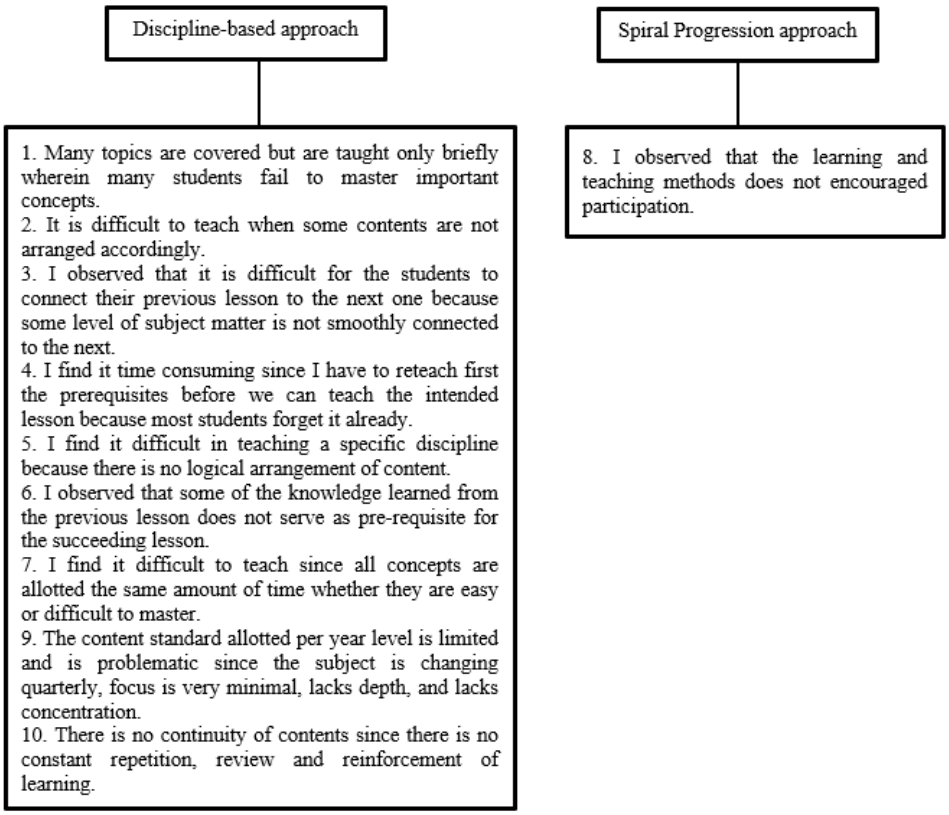

Figure 3
Illustration showing the science teachers' difficulties for the two curriculums

The figure above shows the statements on teachers' difficulties in teaching the two curriculums. Descriptive analysis shows that teachers disagreed only one statement in the k12 curriculum which means this is the only statement that is not observable in the k12 curriculum.

Of the 10 statements for difficulties, nine (9) statements were disagreed by the science teachers in the case of the discipline-based approach. These statements were not observable in the old curriculum.

CONCLUSION, DISCUSSION AND SUGGESTIONS

This study focuses on the past and present experiences and difficulties of science teacher in teaching using the discipline-based approach and spiral progression approach. Descriptive analysis shows that the science teachers agreed that they have experienced those statements about content for both curriculum and it shows nothing unique for the k12 curriculum. But in terms of difficulties, most science teachers agreed that they have those difficulties mostly in teaching the k12 curriculum.

The results in the experiences of science teacher shown in Figure 2 tells that both the old and new curriculum has followed the aspects of what a good curriculum content must have and some of the features are only observable in the old curriculum and nothing unique was found in the new curriculum. This result must be because the new curriculum abides with the standards/criteria in

making a curriculum but it seems that the things that they have in common is only about knowledge content and what is not found in the new curriculum is the things with regards to the arrangement/distribution of contents.

When teachers continue to use this new curriculum implemented by the department, problems will continue to arise if this matter will not be taken seriously. There have been reports already of teachers and students complaining about the new curriculum implemented. To avoid such things, curriculum developers must re-examine or re-evaluate the implementation of the new curriculum and be open to improvements or revision. They must take into consideration the content arrangement and distribution of the different branches of science in each different levels and quarters.

Science teachers were also asked about the difficulties they have in teaching and including the difficulties they had observed among students. Figure 3 shows that among the 10 statements about difficulty only one statement was not agreeable to the new curriculum which means that this difficulty is not found in the new curriculum.

The statement was *"I observed that the learning and teaching methods does not encouraged participation'* which basically means that the new curriculum encourages participation among students. The reason for this is the spiral progression approach used in the curriculum. The approach is learner-centered and is outcome based which makes it interesting to students. Students who have undergone this curriculum perceived that the science curriculum is progressive and learner-centered (Mangali et al., 2019). The other statements are about difficulty in teaching the subject because of its content arrangement, content quantity and knowledge retention.

These results give a positive part of the k12 curriculum but still needs to cater some concerns about the other difficulties teachers experience teaching the new curriculum. There are two sides of this if it continues. One is that there is more involvement of students in the class and the other is the continuation of difficulties teachers' faces in teaching.

Revision means a change or a set of changes that corrects or improves something according to Merriam-Webster Dictionary. Since this curriculum is still young, there are still areas that can be and needs to be improved. Trance and Trance (2019) stated that both teachers and students agreed that the new curriculum envisions preparing students for quality life, but there are still issues that need to be addressed. With the help of the teachers, the developers and the government, the new k12 curriculum will be a greater tool for improvement of the quality and standard of education in the country.

Comments for the Science Curriculum

Teachers identified areas that need improvement in the k12 Science curriculum. The following are the themes based on the data gathered from Part IV of the questionnaire:

Comment 1: Contents of the Science curriculum must be rearranged.

Science teachers suggested that some contents of Science curriculum must be rearranged. One respondent stated that *"I suggest the topics Elements and Compounds will come first followed by substances and mixtures and then solutions"* while another researcher suggest that *"identifying or naming common laboratory apparatus should be introduce first before doing any science experiment"*.

This disarrangement of some contents might be caused by some reasons. One of these is the rushing of the government to implement K12 curriculum within a short time of preparation while another reason is there is no involvement of actual teachers in the curriculum planning and development. This issue will result to multiple issues that affect not just how the teacher teaches but the students' learning as well.

Since the k12 curriculum is still in the process of full implementation, the curriculum can still be improved or revised to cater this issue. Other measures can be done by the teachers like not following the arrangement in the curriculum but still follows what is the content of the curriculum.

Comment 2: There are problems in time management due to range of contents.

Science teachers have stated problems in managing their time in discussing topics for some subject content are very broad that needs to be tackled in only one quarter while there are quarters that have fewer topics to be discussed. This might be because it was not taken into consideration the difficulties of some topics and the uniqueness of each learner, since not all learners learn at the same time.

Few of the teachers stated that *"some topics of this area are broad and learners need ample time to understand and learn the content especially most of the learners today are not fast learners"* and *"too plenty of contents yet cannot be covered in only one grading period. For the students to master the skills incorporated with the contests, they need ample of time to practice since not all of the learners are fast in catching up the lesson especially in Genetics topic*".

Another is that it is not so specified in the curriculum the difficulty of some topics. In some quarters, only few topics are there. Since the K to 12 curriculum uses spiral progression approach which means that in every quarter a different branch of science is being taught, if some topics are broad the teacher will either not finish the whole lesson or teaches the lesson very fast just to finish the topics in every quarter which is commonly happening in the reality.

When a new science curriculum was implemented in Kuwait, the same thing was experienced by science teachers. The science class time was limited, and it was difficult for them to cram all of the course content into each session (Alshammari, 2013).

To ease this issue with time management, there are possible solutions that can be done in the teachers' part or by the department. If the teacher cannot finish the topics in the limited time given, the teacher can either have remedial/special class or just continue the topic elapsing in the next quarter. It is not good for the students to just hurry the discussion to be able to finish the whole topic. It should be "Knowledge before content". The implementing committee can still make improvement in the implementation of the k12 curriculum so the curriculum itself is not yet perfect and revisions are still possible.

Comment 3: There is discontinuity of topics in the Science curriculum.

Science teachers have found out that some topics are not connected or related to the next topic to be taught in the K12 science curriculum. One science teacher stated that *"some of the competencies here are not pre-requisite for the succeeding lesson so it's difficult for the students to connect (link) one topic to another"* and another teacher added that *"There is no connection with the second module to ecosystems.*

With having limited time in preparation of the k12 curriculum, developers rushing to finalize the curriculum were not able to observe such discontinuity. And due to lack of time, no deep evaluation/criticizing might be done. Another reason was stated from the study of Hernandez (2021), wherein it was found out that teachers find it difficult to connect the topics from one grade to another because some of the teachers failed to finish the allotted coverage of the content. Discontinuity of topics causes misconceptions and less retention to students for the topics jumps directly to the next level or some topics are being scrambled. Improving or revising the curriculum is another solution to these problems with the help of the expert and evaluation of persons with expertise in this field.

Comment 4: There are suggested additional topics in the Science curriculum.

As science teachers taught using the k12 curriculum, they suggested that some topics are not found in the curriculum which is needed in teaching and is also important to the learners. One science teacher stated that *"Laboratory Apparatus should be included with procedures and safety in the Lab in grade 7 first quarter"* while another also suggested that *"Additional topic must include: Fundamental unit, Basic lesson in physics or dynamics"*.

These suggestions were given by the teachers since some areas in the curriculum has fewer topics that needs to be discussed in a wider period of time while other lessons are broad for a short amount of time. And also, because it was found out in this study that there is discontinuity of some lessons in the curriculum. If these suggestion topics will not be included, learners will proceed to higher level of education half-filled. They lack the certain information they might need in the future. This agrees with Balbag's (2018) study in Turkey, which states that a concept in science should be included in the Science curricula as it is a requirement of the spiral program.

In order to accommodate these suggestions from the teachers, the curriculum developer must also consider what the teachers had experienced for they are the ones implementing the new curriculum. These suggestions can be considered if the revision of the curriculum will be undertaken.

Based from the results of the study, the new science curriculum has misalignment of contents that causes confusion among science teachers. This study concludes that the past and present experiences and difficulties of science teachers in teaching using the new and old curriculum guides the science teachers in choosing their preferred arrangement of content of the Science curriculum.

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