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DISCIPLINE-BASED VS. SPIRAL LEARNING APPROACH TO SCIENCE EDUCATION: A CRITICAL ANALYSIS IN THE PHILIPPINE SETTING

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Abstract

The Philippines started the K to 12 curricula and spiral progression approach in 2012 turning back from the discipline-based curriculum. Many educators and researchers that it is a must to transfer to the spiral progression approach. This paper examined and evaluated both approaches based on various literature in the context of the Philippines since many people have appealed to go back to the old system. There is overwhelming literature that suggests the benefits of the spiral progression approach in terms of the academic achievement of students and mastery of learning. There was much literature also saying that there is a wide-ranging need for improvement in this spiral progression and K to 12 curricula as a whole. Being said, the country should overhaul the system but not abolish it. There are more benefits than harm in the spiral progression and K to 12 systems.

Keywords: discipline-based approach, Philippines education, spiral curriculum

Introduction

The recent clamor from the people insinuated the current Marcos administration to review the K to 12 educational programs of the country. There were calls that the 10-year program of the old Revised Basic Education Curriculum (RBEC) was better compared to the existing 12 years of basic education. The previous curriculum contains six years of elementary education and four years of high school while the present one has one year of kindergarten, six years of elementary, four years of junior high school, and two years of senior high school. The K to 12 mandates a child to finish a total of 13 years of basic education.

The old curriculum uses a discipline-based approach while the K to 12, under the Republic Act No. 10533, should use a spiral progression approach. The discipline-based curriculum is a model in which each subject matter is separated from another discipline in terms of content and pedagogy (UNESCO, 2022). Gibbs (2012) argued that the disciplinal approach to organizing science instruction is more traditional since each science subject is taught in isolation from another discipline. The subjects in high school were: integrated science in the first year; biology in the second year; chemistry in the third year; and physics in the fourth year. The K to 12 curriculum uses a spiral progression approach. The subjects were the same throughout grade three to junior high school which are physics, biology, chemistry, and earth and space sciences. As the curriculum progressed the subjects become more complex and their application to practical life developed extensively until students master the subject content (Dunton & Co, 2019).

The spiral progression approach in organizing science lessons is more relevant in the modern age of education. It creates mastery of the lesson than using a disciplinal approach. Moreover, to sort everything out on this highly debatable topic in science education, this paper reviewed literature from various published types of research, opinion articles, and news clips, among others. This paper balanced the benefits and disadvantages of both approaches to science lessons in this modern time concerning the Philippine educational system.

Methodology

This paper is a critical analysis paper of discipline-based curriculum versus spiral learning approach in organizing science-related courses. A critical analysis is a process of evaluating a product or material, (e.g., book, movie, document) to engage the readers instead of simply accept what the facts mentioned by the product (Saint Mary's University, 2017). The Writing Center of the University of Washington cited that critical analysis is to make an argumentation out of the arguments provided by the author of the material being critiqued.

The materials that were used for this critical analysis paper were that literature regarding discipline-based curriculum versus spiral learning approach. These are articles published in various countries. The purpose is to give enlightenment to the readers of this matter on what would serve best the Philippine educational setup in terms of the two approaches. The parameters of comparison were the academic achievement of the students, worldwide utilization, and students' mastery.

Discussion

The following themes are the parameters used by this paper to compare the two approaches. This includes the critique of the related literature.

Academic achievement of students

The majority of the literature cites that a discipline-based approach to organizing science lessons has brought students less engaged in the class and their performance was much better in either an integrated approach to teaching and learning or a spiral progression approach. The study of Cooles, Harrigan-Vital, and Laville (2014) in the United States argued that transfer from traditional discipline-based education to an integrated approach has brought a tremendous increase in the performance of medical students during an external assessment. Moreover, the dissertation of Cordogan (2001) compared discipline-based students and interdisciplinary students in terms of academic performance and American College Test (ACT) admission results. There is an overwhelming indication that interdisciplinary students were better in both academic performance and ACT results. In support of this, Garcia (2020) deepens into the perception of students and teaching by using the spiral curriculum. He found out that there is a positive standpoint among teaching on the use of the curriculum and that there is a fairly satisfactory academic performance among students of grade ten in Pasig City. Following this note, a study from Capiz by Dunton and Co (2019) cited very satisfactory academic results in using the spiral progression approach. A qualitative study by Mangali et al. (2019) provided more vivid results based on the lived experiences of the students. They argued that students of Manila were hopeful about the curriculum since it is more progressive than the old curriculum and they are learning at difficult stages.

On the other hand, the study of Venville, Wallace, Rennie, and Malone (2010) in Western Australia reports that most teachers prefer a discipline-based educational setup and that there are few benefits of integrated teaching in science and technology, and mathematics. Teachers raised issues on how to start and its implementation and possible implications in departmental structures. The research paper published by Magana, Falk, and Reese (2013) offers a different view wherein they found out that discipline-based computing can promote the acquisition of knowledge and its application. Their study is unique since students were exposed to a discipline-based curriculum since the beginning of their journey at the university.

The review of literature most perceived the disciplinal approach to be effective in higher education and the spiral progression approach in basic education. However, the disciplinal approach alone cannot assume to be effective as the literature said. There must be an integration which can be said interdisciplinary approach toward promoting higher learning outcomes in higher education (Corbacho & Basile, 2021). The Philippines' setup of the K to 12 and its spiral progression approach has gained ground in promoting students' academic success in basic education.

Worldwide utilization

The majority of high-income countries are using the spiral progression approach in their basic education except for the United States America (USA) which used the curriculum only until grade 9 (de Dios, 2013). The USA covers a wide and broad range of topics like Zoology and Environmental Science and Chemistry only in Grade 11 and Physics alone in Grade 12 (Ireland & Moothan, 2020). This wide coverage of science and math topics in the US curriculum was coined to be mile wide and inch deep which means that there is a shallow learning and broad coverage of topics.

The Trends in International Mathematics and Science Study (TIMSS) study in 2019 has offered new insight into the effectiveness of the spiral progression approach as most countries with high average scores utilized spiral progression as their national curriculum. Looking at Singapore which has 595 average marks, the highest, has leaped forward to solve its education problem at the start of 1980 when it performed low in international assessments. The solution was to incorporate the western standard of teaching most prominently the spiral curriculum. One could say that the curriculum of Singapore is a unification of various effective worldwide teaching strategies (Maths No Problem, 2022). According to Ng (2022), Singapore mathematics, the most famous Maths approach, follows the model method that incorporates spiral structure in the mathematics curriculum. He emphasized that the spiral progression commences, integrates, and intensifies the knowledge of a student.

Finland with a TIMSS average score of 555 started using the spiral progression approach in its national curriculum starting in the 1970s while Austria utilized it in 1975. Both countries implement an impressive system of basic education. A study on multigrade practices in both countries has found the use of a spiral curriculum with the integration of other highly effective teaching practices and peer tutoring has proven to foster educational success among students (Hyry-Beihammer & Hascher, 2015).

Mastery of students

Pearson and Flory (2014) define mastery of learning as a deep understanding of a lesson before moving to the next lesson which is a requirement for students to demonstrate. Idaho Government (2012) describes it as an idea that students should possess content and skills and be able to showcase them in a product or performance tests. Both descriptions depict that students should demonstrate what they learned in content and skills by passing a test, submitting a product, or performing a skill.

Because of the discipline-based organization of science lessons, Wiggins (1991) believed that schools fail to know how to learn and essential skills of inquiry neglected is due to the discipline-based curriculum which promotes content-based teaching and learning and testing. A study in Indonesia by Chai, Rahmawati and Jong (2020) supports the idea of Wiggins. They found that Science Technology Engineering and Mathematics (STEM) students, under a content-based curriculum, failed to connect their content knowledge to its more real-world application. The pre-service teacher-students recognized that teaching is more comprehensive and extensive and there should be an interdisciplinary way of explaining a lesson to the students. However, Gardner (2007) argued that students must venture first into a discipline-based approach to learning before doing interdisciplinary work to master content knowledge.

The spiral progression approach can go in synchrony with mastery learning. Since 1980 literature had been promoting spiral progression to attain mastery (e.g., Aviles, 1998; Kryzanowski & Carnine, 1980; & Yang, 2007). Yang argued that there is increased retention of learning which leads to mastery in the spiral progression approach. This is true since the spiral progression approach revisits the topics, in complex form, as the student progressed in the spiral stages.

In the context of the Philippines, there is no doubt that the spiral progression approach can lead to mastery of learning (Igcasama, 2021). However, there were loopholes that researchers have seen in the country's spiral progression curriculum. According to Orale and Uy (2018), the spiral curriculum can be dangerous to our system of education without the needed support for teachers like resources, appropriate competencies, and encouraging educational policies. They pointed out that the mass promotion in the country makes the spiral system fragmented. There is still mile-wide inch-deep teaching in the new K to 12 as the education department failed to decongest the curriculum (Dio, 2020).

Therefore, there is a true need to revisit the K-12 curriculum of the country as demanded by various sectors of the country. The government is doing it right now. The education department should see to it that the spiral curriculum is indeed spiral. There is a sharp contrast between the western spiral progression and the Philippines spiral progression. In the western countries' curriculum, the topic momentum is taught in lower secondary (Grades 6, 7, 8) and again in Grade 9 and again in Grade 11. In each grade level, the topic momentum is increasing in complexity, depth, and application. Whereas, in the Philippine setup of the spiral, the topic momentum is only taught in grade 9 only. This is just one example. To truly master the spiral progression approach, topics must be revisited at every stage.

However, the K to 12 should not be abolished but the curriculum should be decongested and lean to a more western style of system. There is overwhelming literature that guaranteed the educational success of students under spiral progression and K to 12 basic education.

Conclusion

This paper successfully evaluated both the disciplinal approach and spiral progression approach in organizing science lessons based on various kinds of literature. From the literature, this can be said that the Philippines' basic education sector must adhere to the present K to-12 system and its spiral progression approach. The reasons are: there are good chances of academic achievement of students, the majority of countries around the world, most importantly the major economies and countries top in TIMSS, are using it; and finally, it guarantees mastery in learning. Although academic achievement can also attain such a feat, major literature suggests that students failed to connect their content knowledge to the real-world application of that content. The Philippines needs an interdisciplinary and spiral curriculum as the country progressed on this globalized planet. The government should set the bar high and find an avenue to lift us from this peril of always being below the table in international tests.

If the country turns its back to the spiral curriculum and K to 12, the students are again underserved and may be miles lagging behind their peers in other countries. People must stop their clamoring to abolish the present system and leave their nostalgic memory to their dreams. Filipino children need the spiral curriculum and K to 12 to advance their way in this highly competitive world and we must support them.

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