The Level of Impact on Spiral Progression Approach in Mathematics to the Academic Performance of the Grade 10 Students

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Abstract: The study was to determine the level of impact of spiral progression approach in mathematics to the academic performance of the grade 10 students in Ampayon National High School. Three specific questions were raised to determine: (1) extent of students' participation in the spiral progression approach in Mathematics in terms of discussion, peer collaboration, and problem-solving activities? ;(2) what is the level of student's academic performance in mathematics from grade 7 to 10?; and (3) is there a significant correlation between the extent of student participation in spiral progression approach in mathematics and the academic performance of the students? Some statistical measures were used on the analysis of data. The mean was utilized to determine the level of extent of the students' participation in spiral progression approach in terms of discussion, peer collaboration, and problem-solving activities, as well as the level of students' academic performance in four corresponding years. The Pearson's correlation was used to determine the significant impact of students' participation in Spiral Progression. Teaching Approach in mathematics to the academic performance of the respondents. This study concluded that the extent of students' participation in peer collaboration, and problem-solving activities did not merely influence the students' academic performance. However, there is a significant correlation between the extent of student participation in spiral progression approach in mathematics and the academic performance of the student in the discussion. This means that students were motivated to learn when the teacher presents the process well and they were interested to participate during the discussion. Hence, the students' participation had influenced their academic performance.Based from this conclusion, this study suggested that the teacher should employ techniques and strategies that are appropriate to the leaners' needs and abilities, and the students should also be attentive and participating during discussion to acquire effective learning.

Keywords: teaching approach ,Spiral approach, academic performance

THEORETICAL AND CONCEPTUAL FRAMEWORK OF THE STUDY

This study centred on the theory that spiral progression approach is a factor that contributes to the academic performance of the grade ten students. This is supported by studies conducted by various researchers and educational thinkers.

This study is anchored the theory Spiral Progression which was proposed by Jerome Bruner with principles derived from John Dewey.

The Spiral Progression is predicated on cognitive theory advanced by Jerome Bruner (1960), who wrote, "We begin with the hypothesis that any subject can be taught in some intellectually honest form to any child at any stage of development". In other words, a very young children is capable of understanding even a most complex material if it is structured and presented properly.

In the book, The Process of Education, Bruner (1960) opposed Piaget's notion of readiness. He argued that schools waste time trying to match the complexity of subject material to a child's cognitive stage of development. This means that the students are troubled to understand certain topics since it is considered to be too difficult to them, and those topics must be taught when the teacher believes the child has reached the appropriate state of cognitive maturity.

Bruner suggested that curriculum should be designed in a way that it pursues a spiral progression that starts from simple to complex and requires revisiting prior knowledge (1960/1977). In short, students continuously build concepts upon what already know and return the basic ideas until they grasped the full formal concept. Therefore, subjects would be taught at levels of gradually increasing difficulty.

Bruner emphasized the gains that can be acquired by developing student's power of analysis, judgement and memory in or to increase capacity to transfer learning (Hatuina, 2013). His idea was that, transfer of thinking processes from one another which require students to learn the fundamental principles of subjects and to explore ideas on a deeper level rather than just mastering facts rote learning procedures.

Learning also involves memory or remembering. In spiral progression approach, memory is very important factor. There are two basic theories to explain as how we memorize events. According to one theory memory is said to be stored in the brain as a memory trace. When we learn or experience something, impulses are generated in the nerves of the brain. These impulses impart their effects in the brain in the form of a record. According to the other theory, sensations created by learning produce some permanent changes in the brain which remain there in the form of memory (Espiritu, 2008).

Bruner (1961) proposes that learners' construct their knowledge and do this by organizing and categorizing information using a coding system. Bruner believed that the most effective way to develop a coding system is to discover it rather than being told it by the teacher. The concept of discovery learning implies that students construct their own knowledge for themselves, also known as constructivist approach.

Moreover, the teacher's role is to facilitate the learning process rather than to teach information by rote learning. The use of the spiral progression approach can aid the process of discovery learning if teachers give students the information they need through discussion, but without organizing for them.

The spiral progression approach is also said to be a "child-centered approach". According to Angeles (2013), the new curriculum is composed of set of activities like, collaborative learning, peer tutoring, outcome-based performance or performance task. In which the students are exposed to socializing, sharing thoughts and ideas or brainstorming, communicating, expressing their multiple intelligences, abilities and skills. Hence, the students will be able to achieve better understanding of the concepts of a subject matter if they are participating to the activities conducted by the teacher such as peer collaboration, and problem solving.

The conceptual pattern shows that the researchers considered the connection of independent variables to the dependent variable, as shown in figure 2.

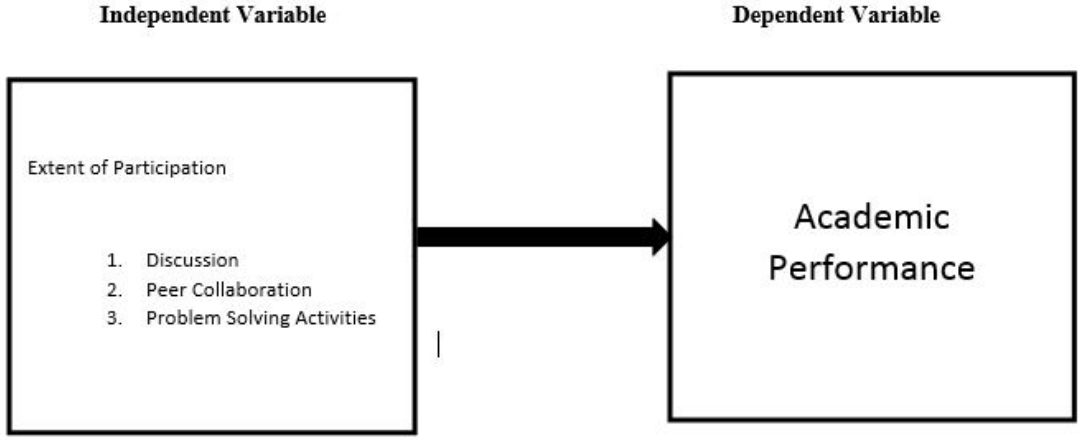

Figure 1. Schematic diagram of the study.

Hypothesis

The problems pose one null hypothesis:

Ho1: There is no significant correlation between the extent of student participation in spiral progression approach in mathematics and the academic performance of the grade 10 students in Ampayon National High School.

METHODOLOGY

This study used the descriptive method of research. It was a fact-finding study with sufficient interpretation and evaluation. It also gathered data and information of the level of impact of spiral progression to the academic performance of the students.

The study was conducted in Ampayon National High School, Butuan City. It is about 1.2 kilometers far from Caraga State University. It can be reached by a bikecab, motorcycle or jeepney for abour 4-6 minutes.

The respondents of the study were the three sections of grade 10 students in Ampayon National High School, Butuan City as presented in Table 1.

Table 1 *Distribution of Population*

Section	Population	Sample Size (n)
1. Einstein	48	34
2. Galileo	44	33
3. Newton	48	29
Total	140	96

A survey questionnaire was used during the baseline survey for the evaluation of some questions added to address specific areas to be explored. The researcher administered the questionnaire used to collect data from the students. This data includes that parts of the questionnaire: Part I contains the information of the student, specifically, the Academic performance from grade 7,8,9, up to the first quarter in grade 10. Part II contains questions about the extent of student's participation of the curriculum in terms of: Discussion, Peer Collaboration, and Problem Solving Activities.

Scoring and Quantification of Data

The following were quantified to be used for statistical analysis:

A. Academic Performance

Grade Ranges	Level	Descriptive Rating
95-above	5	Outstanding
86-94	4	Very Satisfactory
80-85	3	Satisfactory
75-79	2	Fairly Satisfactory
Below 75	1	Did not meet expectation

B. Student's Participation

Scale	Verbal Description	Interpretation
4.5-5	5	Very High
3.5-4.49	4	High
2.5-3.49	3	Moderate
1.5-2.49	2	Low

1-1.49	1	Very Low

RESULTS AND DISCUSSION

Problem 1: What is the extent of students' participation in the Spiral Progression Approach in Mathematics in terms of discussion, peer collaboration, and problem-solving activities.

Table 2: *Extent of students' participation in spiral progression approach in Mathematics in terms of discussion.*

Indicators	Mean	Std. Deviation	Verbal Description	Interpretation
1. I like the way Math in every grade level has different branches.	3.73	0.79	Agree	High
2. I like to recall every lesson I've learned in math every year with increasing complexity.	3.86	0.82	Agree	High
3. I am eager to listen when our teacher recalls the past lessons.	4.03	0.76	Agree	High
4. I feel easy to learn math since all topic/branches of math were taught in order of difficulty and actively engaged in solving problem.	3.31	0.85	Moderately Agree	Moderately
5. I am interested to participate in the discussion.	3.94	0.95	Agree	High
6. I actively participate to the discussion.	3.63	1.07	Agree	High
7. The lessons in math are very useful in our everyday life.	4.21	0.91	Agree	High
8. I am not confused to every lesson I meet in every grading period.	3.44	0.87	Moderately Agree	Moderate
9. I am motivated to learn when my teacher presents the process well.	4.19	0.79	Agree	High
Overall	**3.81**	**0.51**	**Agree**	**High**

Table 2 showed the extent of students' participation in the discussion. It showed that students agreed mostly on the indicators 1,2,3,5,6,7, and 9 with a mean value of 3.73, 3.86, 4.03, 3.94, 3.63, 4.21, and 4.19 respectively. It implied that students agreed that they like the structure of how math is taught- which has different branches in every grade level; they also like to recall every lesson they've learned in math every year with increasing complexity; they are eager to listen when their teacher recalls the past lesson, and presents the process well they were interested to participate in the discussion actively. However, they moderately agreed on the remaining indicators which are indicators 4, and 2, which have a mean value of 3.31, and 3.44.

The overall mean value 3.81, which has a verbal description "Agree". This means that learners have a high level of participation in the discussion towards learning Mathematics lesson.

Table 3: *Extent of students' participation in the spiral progression approach in Mathematics in terms of peer collaboration.*

Indicators	Mean	Std. Deviation	Verbal Description	Interpretation
1. I am motivated to listen when there are group/diad activities.	3.99	0.84	Agree	High
2. I like to share my understanding of the lesson to my classmates.	3.89	0.79	Agree	High
3. I feel it easy to learn different topics in math when being taught or guided by my classmates.	3.66	0.94	Agree	High

4. I like learning my lessons in math with my classmates.	3.80	0.80	Agree	High
5. I learned to cooperate with others group activities.	3.95	0.70	Agree	High
6. I work cooperatively with any group member in seeking solutions to the problems	3.77	0.80	Agree	High
7. I can easily ask questions from my groupmates.	3.67	0.82	Agree	High
8. I am not hesitant to solve some problems when I'm with the group.	3.33	0.87	Moderately Agree	Moderate
9. I can compare my answers with my group mates amd determine if I got the right answer.	3.76	1.02	Agree	High
10. I learn some easy techniques of solving from the ideas of our group mates.	3.79	0.97	Agree	High
Overall	**3.76**	**0,44**	**Agree**	**High**

Table 3 presented the extent of students' participation in the peer collaboration of the students in learning Mathematics. It can be seen that out of 10 indicators, 9 were rated as "Agree", as evident on indicators 1,2,3,4,5,67,9 and 10. These nine(9) indicators has mean value of 3.99, 3.89, 3.66, 3.80, 3.95, 3.77, and 3.67 respectively. This means that students agreed that they were motivated to listen and learn when there are group activities, and when being taught or guided by their classmates; they liked to share their understanding of the lesson to their classmates; they can easily ask questions in seeking solutions; they worked cooperatively with their group; they can compare their answers; and they learned some easy techniques of solving from the ideas of their classmates. However, they moderately agreed on indicator 8 which a mean value of 3.33. It implies that they moderately agree they are not hesitant to solve some problems when they are with their group.

The overall mean value is 3.76 with a verbal description "Agree". It reveals that the students have a high level of participation in peer collaboration. They learned better in Mathematics when their classmates accompanied them.

Table 4: *Extent of students' participation in the spiral progression approach in Mathematics in terms of problem solving.*

Indicators	Mean	Std. Deviation	Verbal Description	Interpretation
1. I can easily answer the given problem since I already had a prior knowledge about it.	3.52	0.91	Agree	High
2. I am confident in my answer in every problem solving activities.	3.52	0.92	Moderately Agree	Moderate
3. I got correct answers in every problem solving activities/written books.	3.16	0.80	Moderately Agree	Moderate
4. I like to answer the different branches/topics in math every year.	3.44	0.88	Moderately Agree	Moderate
5. I am not confused to every problem given to me in every grading exams.	3.34	0.89	Moderately Agree	Moderate
6. The problem solving activities that we met every year level doesn't show shocking difficulty.	3.32	1.07	Moderately Agree	Moderate
7. My problem solving skill enhances when my teacher give board works, seat works, and problem sets.	3.89	0.90	Agree	High
8. I am solving my assignment with the used of basic problem solving skills learned from my teacher.	3.92	0.89	Agree	High
9. I search another set of problems to practice, improve, and master my problem solving skills.	3.50	1.03	Moderately Agree	Moderate
10. I am more comfortable to the steps presented by the teacher.	3.79	1.01	Agree	High
Overall	**3.51**	**0.60**	**Agree**	**High**

Table 4 showed the extent of students' participation in the problem solving activities. As observed, indicators 1,7,8, and 10 has a mean value of 3.52, 3.89, 3.92, respectively with a verbal description "Agree". They agreed that they can easily answer the given problem since they had a prior knowledge about it; their problem solving skill enhances when their teacher give board works, seat works, and problem sets; they are solving their assignment with the use of basic problem solving skills learned from their teacher; and they are comfortable to the steps presented by their teacher.

However, indicators 2,3,4,5,6, and 9 have a verbal description "Moderately Agree" as evident on the mean values 3.32, 3.16, 3.44, 3.34, 3.32, and 3.50 respectively. This implied that they moderately agreed that they are confident in their answer in every problem solving activities; they got correct answers in every problem solving activities/written works; they liked to answer the different branches/topics in math every year level; they were not confused to every problem given to them in every grading exams; the problem solving activities that they met every year level doesn't show shocking difficulty; and they search another set of problems to practice, improved, and mastered their problem solving skills.

The overall mean value was 3.51, with a verbal description "Agree". It revealed that the students have a high level of participation in problem solving activities. This means that they liked to engage themselves in problem solving activities.

Problem 2: What is the level of students' academic performance in Mathematics in four (4) corresponding years?

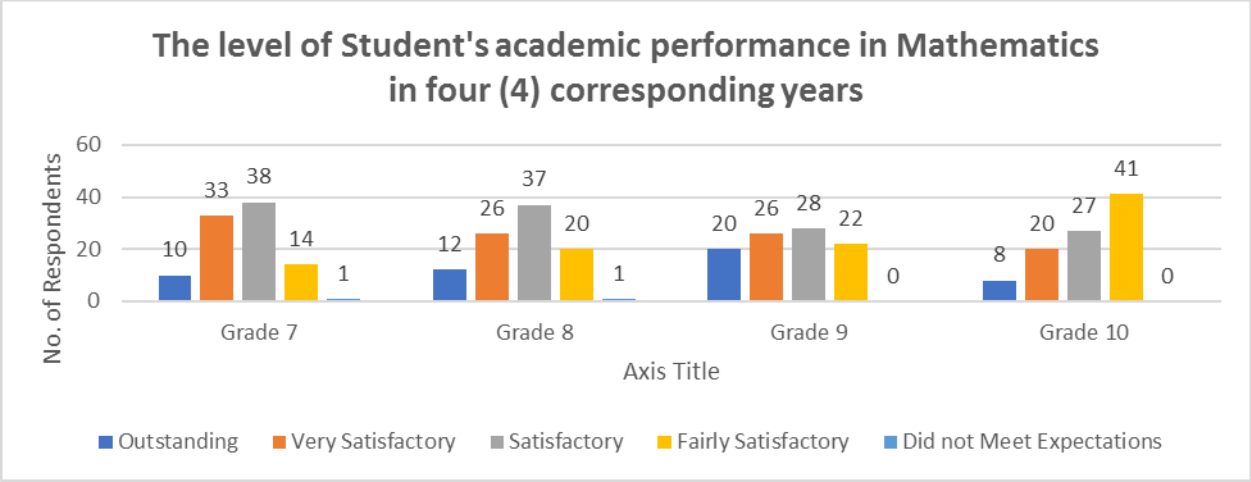

Figure 3. The level of students' academic performance in mathematics in four (4) corresponding years

Figure 3 shows that most of the respondents got "Satisfactory Level" on academic performance in Mathematics from grade 7 to grade 9, which have grades ranging 80-85. It implies that the level of their academic performance in 3 consecutive years does not change, but there is an improvement since the number of respondents who belong to the outstanding level increases.

However, most of the respondents got "Fairly Satisfactory Level" of academic performance in mathematics for the first quarter of the current grade level-grade 10 which has grades ranging 75-79.

Overall, the level of students' academic performance in mathematics in four (4) corresponding years has an improvement but there's a bit change to their academic performance in grade 10, since the data collected on the said grade

level was the first quarter academic performance. Improvement of the student's academic performance is the effect of the implementation of the curriculum. Thus, the findings indicate the applied curriculum. Thus, the findings indicates that the applied curriculum is effective on the students with a satisfactory level.

Problem 3: Is there a significant correlation between the extent of student participation is Spiral Progression Approach in Mathematics and the academic performance of the student?

Table 5. *The significant correlation between the extent of students' participation in the Spiral Progression Approach in Mathematics towards the academic performance of the student in the 7th grade.*

Grade 7			
Activities	**Performance**		**Impact Description**
	Pearson R	**P-value**	
Discussion	0.07	0.52	Not Significant
Peer Collaboration	0.12	0.23	Not Significant
Problem Solving Activities	0.01	0.92	Not Significant

Table 5 revealed the result that the extent of students' participation on the classroom activities has no significant influence to the academic performance of the respondents during their 7th grade level. This finding implies that the activities does not merely contribute in improving their academic performance.

Table 6. *The significant correlation between the extent of students' participation in the Spiral Progression Approach in Mathematics towards the academic performance of the student in the in the 8th grade*

Grade 8			
Activities	**Performance**		**Impact Description**
	Pearson R	**P-value**	
Discussion	0.07	0.03	Not Significant
Peer Collaboration	0.10	0.35	Not Significant
Problem Solving Activities	0.04	0.70	Not Significant

Table 6 revealed the result that the extent of students' participation on the classroom activities has no significant influence to the academic performance of the respondents during the 8th grade level. This finding implies that the activities does not merely contribute in improving their academic performance.

Table 7. *This significant correlation between the extent of students' participation in the Spiral Progression Approach in Mathematics towards the academic performance of the students in Grade 9*

Grade 9			
Activities	**Performance**		**Impact Description**
	Pearson R	**P-value**	
Discussion	0.22	0.03	Significant
Peer Collaboration	0.12	0.25	Not Significant
Problem Solving Activities	0.05	0.60	Not Significant

Table 7 represent the result of the Pearson R between the extent of students' participation on the classroom activities and performance in grade 9. It can be shown that the discussion under activities has a P-value of 0.03, which is

less than 0.05, this implies that the discussion has an influence to the academic performance of the respondents in the 9th grade level. This finding indicates that the discussion has a great role to improve the performance of the respondents because the implementation of the spiral progression curriculum in this grade level is evident in the process of discussion.

Table 8. *The significant correlation between the extent of students' participation in the Spiral Progression Approach in Mathematics towards the academic performance of the student in Grade 10*

Grade 10			
Activities	**Performance**		**Impact Description**
	Pearson R	**P-value**	
Discussion	0.22	0.03	Significant
Peer Collaboration	0.12	0.26	Not Significant
Problem Solving Activities	0.05	0.60	Not Significant

Table 8 represent the result of the Pearson R between the extent of students' participation on the classroom activities and performance in grade 10. It can be shown that the discussion under activities has P-value of 0.03 which is less 0.05, this implies that the discussion has an influence on the academic performance of the respondents in grade 10. This finding indicates that the discussion has a great role to improve the performance of the respondents since all of the prerequisite concepts of their math subject that were taught from lower grade level were included in their discussion.

CONCLUSION

Based on the findings of the study, the following conclusions were drawn:

On the level of students' participation in terms of discussion, peer collaboration and problem solving activities, it has been found out that the students have agreed to the statement in every indicator. This implies that the respondents have a high level of participation on the activities in the classroom and they were interested to enhance their learning in mathematics by acquiring the knowledge imparted by their teacher, socialization with their classmates, and by engaging themselves in problem solving activities.

The level of students' academic performance in mathematics in for (4) corresponding years has an improvement but there's a bit change to their academic performance in grade 10, since the researchers had collected the first quarter of their grades in mathematics. This indicates that the applied curriculum is effective on the students with a satisfactory level.

There is a significant correlation between the extent of student participation in spiral progression approach in mathematics towards the academic performance of the student in the discussion in grades 9 and 10. This means that the students were motivated to learn when the teacher presents the process well and they were interested to participate during the discussion since the prerequisite concepts of their math subject that were taught from previous grade levels were included in their discussion. Hence, the students' participation had influenced their academic performanceHowever, the students' participation in peer collaboration, and problem solving activities did not merely influence the students' academic performance.

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