ACTIVE LEARNING APPROACHES IN TEACHING PHYSICAL SCIENCE: DIRECTION TOWARD ENHANCED THINKING SKILLS OF GRADE 12 SENIOR HIGH SCHOOL STUDENTS

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ABSTRACT

The study attuned the learners' preferred modality of learning and teaching methods through inventory of students' preferences in terms of active learning approaches, find out the effects of the employment of respondents' preferred approaches in enhancing low order and high order thinking skills in Physical Science subject and ascertain the most effective to enhance such skills. To align the preferred learning and teaching approaches of both the students and the teachers, the study purposively involved 92 students from three different sections of Grade 12 in Recto Memorial National High School, Tiaong Quezon and employed experimental method of research. Using inventory, t-test, and ANOVA as statistical tools, findings revealed that the preferred active learning approaches of the Senior High School Students are collaborative, inquiry-based, and reflective. Moreover, both the mean pre and post-tests in low and high order thinking skills of the three (3) preferred active approaches were found to have a significant difference. However, there are no significant differences among analyzing and evaluating sub-skills, and applying sub-skill of the three groups and higher order thinking skills of the groups particularly in creating sub-skill. Finally, there are significant differences among the low order thinking skills of the groups specifically in remembering and understanding sub-skills.

Keywords: Active Learning Approaches, Inventory of Preferred Active Learning Approaches, Thinking Skills, Lower Order Thinking Subskills, High Order Subskills

INTRODUCTION

Today's schools are facing enormous challenges. In response to an increasingly complex society and a rapidly changing technology-based economy, schools educate the most diverse student body in history to higher academic standards than ever before. Continuous development in the teaching-learning process of the K to 12 Curriculum becomes a challenge to address the needs of the learners to meet the national goal of the educational sector—to produce lifelong and globally competitive learners. One of the themes enclosed in Department of Education (DepEd) Memorandum No. 39, series of 2016 known as the Adoption of the basic Education Research Agenda is the Teaching and Learning. DepEd seeks to ensure that learning outcomes are achieved by capitalizing on the competencies of teachers and potentials of all types of learners as the national institution mandated to provide quality basic education to all Filipinos. The DepED-CALABARZON releases the enclosed guide entitled "The 2C-2I-1R (Collaborative, Constructivist, Inquiry-Base, Integrative and

Reflective) K to 12 Approaches Across Learning Areas that Support Teacher Practice" for use by all curriculum implementers of DepEd Region IV-A. The five pedagogical approaches known as active learning approaches have customary significant attention over the past several years. It engages that learners in the learning process through activities. The activities vary but require students to do higher order thinking. Thus, one of the primary concerns of the teachers in the classroom is to conceptualize highly engaging teaching strategies to be able to deliver the kind of instruction that the learners truly deserve. Educators on this way need to help students examine their learning preferences and expand or modify them if necessary (Lucas and Corpus, 2014).

Djordjevic (2014) proposed that the role of engaging activities like metaphors, enhanced students' learning of complex topics. Hence, learning approaches must take into consideration, the given type of learner who will be required for the achievement of the learning outcomes, teaching activities, assessment, and time.

The Mean Percentage Scores (MPS) in Physical Science of Grade 12 Students at Recto Memorial National High School, First Semester of S. Y. 2017-2018 was recorded to be 64.58%. This MPS value did not meet the required mean average per subject mandated by the Division Office of Quezon which is 75%. To mend such record, the researcher opted to apply the newly created learning pedagogies of DepEd-CALABARZON. Thus, the study sought to spell out the differences in the learning performances of the learners once exposed to different active learning.

Notwithstanding, this study may also help teachers to gain educationally sound ideas and strategies to improve learning, teaching and assessing in a modularized context. Students on the other hand who will be exposed to the learning approaches may experience varied learning activities that will enhance their thinking skills. Another equity projected from this study is the use of different approaches of delivery, supports students' prerequisites in the course in real classroom scenario. Thus, it may offer learning processes that will facilitate student engagement, enhance relevance and improve enthusiasm by actively involving students within their classroom in a realistic learning environment.

OBJECTIVES OF THE STUDY

The research study was steered to: 1) determine the preferred active learning approaches of the respondents as to constructivist, collaborative, integrative, inquiry-based and reflective; 2) test the significant difference among the mean pre-test and mean post-test of the three groups of respondents in terms of low order thinking skills and high order thinking skills; and 3) determine the significant difference among the mean post-test scores of the three groups of respondents in terms of low order thinking skills and high order thinking skills.

MATERIALS AND METHODS

The study employed experimental method of research and involved the participation of 92 Grade 12 Senior High School students at Recto Memorial National High School in the District of Tiaong, Quezon from the three sections of the academic track. The respondents were purposively selected from the tracks and strands offered in the said school year. Two groups consisted of 31 students each and the other group was composed of 30 mixed male and female students of comparable learning academic performance based on their average rating on their previous grade level and pre-test scores.

The study underwent the following process: Phase I. Preparation and Validation of Survey Questionnaire and Assessment Test, Phase II. Planning and refining of the Matrix of Activities and Lesson Plans, Phase III. Inventory of active learning approaches, Phase V. Execution of the Lesson Plans with Active Learning Approaches, and Phase VI. Administration of Post Test. The inventory survey questionnaire regarding the preferred active learning approaches had undergone cronbach alpha and test-retest

procedures to attest its consistency. A rubric was utilized in rating the work of the learner in the creating level of the assessment and is then transmuted for equivalency (0=60, 1=64, 2=68, 3=72, 4=76, 5=80, 6=84, 7=88, 9=96, and 10=100). Thus, to establish uniformity in the scores, each of the sub-skill raw scores are all transmuted using the above transmutation values.

The data were subjected to the following statistical treatment and analysis: Simple descriptive statistics such as weighted mean and standard deviation were used to present and evaluate the preferred active learning approaches of the respondents and Analysis of Variance was used to find out the differences among the performance of the students with the employment of preferred learning approaches in terms of pre-test and post-test scores at 0.05 level of significance.

RESULTS AND DISCUSSIONS

1. Results of the inventory-survey about the active learning approaches as preferred by the respondents as to constructivist, collaborative, integrative, inquiry-based, and reflective

1.1. Constructivist Approach

Table 1 exhibits the kernel of the mean inventory of the indicators of Constructivist Approach as perceived by the respondents. Indicator number three gained the highest mean with a value of 4.29 and is interpreted as “Highly Preferred.” The above result asserts that learners believed that they could relish learning when they can make connections of the topic to real life situations. This infers that learners’ thinking process are activated whenever they can associate their existing ideas with the new learning that is about to be learned. In a classroom scenario, an active learning process is mirrored whenever there is an exchange of views among the teacher to students, students to students and students to teachers which can be established whenever the students can link their ideas to what the discourse is all about.

Table 1

Preferred Active Learning Approaches as to Constructivist Approach

Indicators *I enjoy the learning session in Physical Science when…*	**SD**	**Mean**	**VI**
1. I am active in the process of constructing meaning rather than passively receiving information to my teacher	0.75	3.82	P
2. I am experiencing learning activities that fosters critical thinking.	0.77	3.72	P
3. I recognize that I can make connections to the topic	0.67	4.29	HP
4. it permits me to experience both contrived and direct learning experiences where I can realize the relation of our topic to what I know about the subject	0.67	3.57	P
5. my teacher models the learning and let us discover it at our own pace through varied activities	0.74	4.08	P
Overall	**0.34**	**3.89**	**P**

Key to Interpretation of the Mean Ratings: *5-4.21- Highly Preferred (HP), 4.20-3.41-Preferred (P),3.4-2.61-Moderately Preferred (MP), 2.60-1.81-Less Preferred (LP), 1.80-1.0-Not Preferred (NP) *This interpretation applies to tables1-6*

1.2 Collaborative Approach

Table 2 depicts the summary of the mean inventory of the respondents’ perceptions about Collaborative Approach. Indicator 5 acquired the uppermost proportion of 4.82 which is also interpreted as “Highly Preferred”. This proposes that the respondents desire to undertake different roles whenever they are in collective learning.

Further, learners can dynamically assume diverse responsibilities as agreed by the group to carry out a learning task that eventually benefit them on their later self-learning since they can actually grasp information on the stuffs that they have performed during the performance of the collaborative work. The above values also infer that the respondents are expected to learn more the subject if they are engaged in a group

concerted effort of working together to convey a common learning goal.

Table 2

Preferred Active Learning Approaches as to Collaborative Approach

Indicators *I enjoy the learning session in Physical Science when…*	SD	Mean	VI
1. I perform group performance rather than individual performance because I can learn more through my classmates' collaborative effort	0.65	4.56	HP
2. I can feel that it will allow me to become attentive listener aside from allowing me to become just a member of a team	0.53	4.76	HP
3. I can develop my potentials to be a leader and a member--supporting my group mates in our learning tasks toward a common goal	0.58	4.64	HP
4. the learning environment anticipates both our academic strengths and weaknesses	0.59	4.65	HP
5. I assume different roles depending on a topic that will be worked out by group	0.39	4.82	HP
Overall	**0.24**	**4.69**	**HP**

The results can be proven by study of Ramos (2018), confirming that through collaborative work, students are always excited and feel that they are part of a team. With this learning atmosphere, the learners can enjoy and be active participants of the learning process.

1.3 Integrative Approach

Table 3 condenses the mean response of the respondents regarding Integrative Approach. As shown by the grand mean of 4.14, respondents agreed that they enjoy learning when the teacher integrates other disciplines in the discussion of topics in Physical Science.

Table 3

Preferred Active Learning Approaches as to Integrative Approach

Indicators *I enjoy the learning session in Physical Science when…*	SD	Mean	VI
1. the learning process helps me to make connections across other fields	0.50	4.05	P
2. my teacher integrates technology in the learning procedure that helps us in linking the theoretical perspective of the topic to their effective application	3.77	4.80	HP
3. the discussion involves the three-way process of communication among us, students to students, teacher to students, students to teacher in explaining the topic	3.97	4.34	HP
4. it allows our ideas to flow freely during the teaching-learning process	0.54	3.87	P
5. I can associate the topic with what is relevant in our everyday living	0.62	3.66	P
Overall	**1.12**	**4.14**	**P**

Learners of this generation are endowed with diverse intelligences. They are vigorous in learning whenever there is something to work on using their intelligence style. And to actualize this diversity in the learning process, teachers indeed must assimilate learning experiences through integration of other fields or disciplines during the discussion.

1.4 Inquiry-Based Approach

Table 4 presents the mean inventory-outcome of the Inquiry-Based Approach as supposed by the respondents. With a grand mean of 4.69, the respondents highly preferred that they enjoyed learning the topics in Physical

Science whenever the lessons are presented in an exploratory manner.

Table 4

Preferred Active Learning Approaches as to Inquiry-Based Approach

Indicators *I enjoy the learning session in Physical Science when…*	**SD**	**Mean**	**VI**
1. it provides us a forum wherein we as learners are given freedom to exercise our theoretical propositions to some form of experimental tasks	0.50	4.49	HP
2. it allows us to manipulate objects, test hypothesis in an exciting manner	0.50	4.58	HP
3. we experience activities to be done in different settings rather than in structured environments	0.56	4.54	HP
4. our teacher serves as a facilitator and gives us the chance to process our learning through exploratory activities	0.24	4.94	HP
5. we are given the chance to interact in a way that we are at the context of the study, able to develop a solution or support a point of view about the subject	0.31	4.89	HP
Overall	**0.22**	**4.69**	**HP**

This surmises that learners are eager to learn when they are involved in investigating the answers to the problems in the instruction. Learners are eager whenever they are given the chance to explore the answers to the problem existing by themselves with the teacher as facilitator. Auxiliary to the above values, this also denotes that through direct investigation and involvement of what is ought to be learned, the learners are able to learn at their own pace, acting as explorer of learning in an exciting manner.

1.5 Reflective Approach

Table 5 indicates the mean inventory result of Reflective Approach in accordance with the perceptions of the respondents. Reflective Approach in the study, gives the learners the opportunities to evaluate their own learning through self-evaluation of their own learning practice. With the range of mean values form lowermost which is 4.86 gained by indicators 1 and 2 and the uppermost mean value of 4.98 in indicator 5, respondents undoubtedly wanted a lesson approach wherein they can actualize their learning through self-reflection and self-evaluation.

Table 5

Preferred Active Learning Approaches as to Reflective Approach

Indicators *I enjoy the learning session in Physical Science when…*	**SD**	**Mean**	**VI**
1. we are given the chance to evaluate our learning through journals or other ways of reflection	0.35	4.86	HP
2. we are able to experience repetition of the learning process after reflecting on with our misconceptions	0.35	4.86	HP
3. we are involved in the purpose and process of evaluation	0.30	4.90	HP
4. we can gain insight in the cognitive process and eventually apply it in our living	0.16	4.97	HP
5. we can experience to analyze our own learning and practice in order to consider other means of achieving our end	0.13	4.98	HP
Overall	**0.12**	**4.91**	**HP**

This also suggests that learners can learn at their best when they are given the chance to check on their misconceptions through reflective learning experience and in the long run of the discussion, enables them to practice their gained skill or learning thus achieving what is expected for them to acquire.

1.6 Active Learning Approaches as to Constructivist, Collaborative, Integrative, Inquiry-Based and Constructivist Approaches

Table 6 displays the comparison among the grand mean of the active learning approaches conferring the perceptions of the respondents.

Table 6
Preferred Active Learning Approaches as to Constructivist, Collaborative, Integrative, Inquiry-Based and Constructivist Approaches

Active Learning Approaches	*Grand SD*	*Grand Mean*	VI
Constructivist Approach	0.34	3.89	**P**
Collaborative Approach	0.24	4.69	**HP**
Integrative Approach	1.12	4.14	**P**
Inquiry-Based Approach	0.22	4.69	**HP**
Reflective Approach	0.12	4.91	**HP**

From the foregoing grand mean values, it can be gleaned that the respondents can maximize their enjoyment in studying and possibly their academic performance in Physical Science whenever they work in collaborative groups (Collaborative Approach), investigating and exploring the answers to the questions involved in the lesson (Inquiry-Based Approach), and can be able to assess their own learning through self-evaluation of their strengths and areas of improvement regarding the topics to be discussed (Reflective Approach). Hence, the three preferred active learning approaches as perceived by the respondents are Reflective, Inquiry-Based and Collaborative Approaches. Results also indicate that understanding the connection between student interest and teaching method preferences, especially interpreting interested students' desire for creative activities, are important aspects for future research.

2. Difference among the mean pre-test and mean post-test of the three groups in terms of low order thinking skills

Table 7
Test of Difference between the Mean Pre-test and Mean Post-Test Scores in Low Order Thinking Skills among the Respondents Exposed Preferred Reflective, Inquiry-Based and Collaborative Approaches

Low Order Thinking Skills	Reflective				Inquiry-Based				Collaborative			
	MD	SD	t-value	p-value	MD	SD	t-value	p-value	MD	SD	t-value	p-value
Remembering	-16.00	8.26	-10.78	0.00	-16.65	6.54	-14.17	0.00	-21.94	6.52	-18.73	0.00
Understanding	-21.42	5.89	-20.24	0.00	-21.68	8.75	-13.79	0.00	-25.81	6.68	-21.51	0.00
Applying	-20.65	7.60	-15.13	0.00	-22.19	7.14	-17.30	0.00	-23.10	8.05	-15.98	0.00

*Legend: degrees of freedom=30 *p<0.05 Significant *p>0.05 Not Significant*
The mean difference used as data in the table is the difference between the transmuted mean of the original pre-test and post-test scores

Table 7 directly shows the difference between the mean pre-test and mean post-test scores among the respondents exposed to the preferred approaches such as reflective, inquiry-based and collaborative. With $p<0.05$, the pre-test and post test scores of the group subjected to reflective approach for the low order thinking skills were significantly different. The result was attributed to the employment of the reflective approach that entails the respondents to think about what they have learned and consequently check their misconceptions after the course of discussion. Imbuing reflective approach in the delivery of the lessons in Physical Science, momentously aided the learners to evaluate their own learning and practically apply it to further circumstances in life, with this regard the post-test. It also presents the magnitude of mean differences in the low order thinking sub-skills of the respondents who experienced inquiry-based approach in their learning process. All the sub-skills in the pre-test and post-test were

significantly different with p<0.05. This may imply that the low order thinking skills of the respondents have a noticeable improvement after exposing them to inquiry-based approach. Salcedo (2016) suggested that discovery approach which is commonly known as inquiry-based approach helped the learners to use the available information that they have during the investigation to undertake new procedure in a familiar situation. More so, connecting it in the study, the learners have used their schema that they have already imbibed during the investigation/exploring process to the new set of learning situation, this time the post-test. Although all the three approaches elucidate significant difference in the low order thinking skills of the respondents, it can be assembled that the respondents under collaborative approach have enormous improvement from their performance from the pre-test to post-test. Mean differences of -21.94, -25.81 and -23.10 at p< 0.05 for remembering, understanding, and applying respectively are being figured out and were interpreted to draw significant differences between the pre-test and post-test mean scores. Hence, the collaborative approach superseded the enhancement of low order thinking skills as equated to the two other approaches—reflective and inquiry-based approaches which further asserts that through collaborative approach, learners' recall, retention, remembering, understanding and applying skills are enhanced as seconded by the previous researches mentioned above.

Table 8

Test of Difference between the Mean Pre-test and Mean Post-Test Scores in High Order Thinking Skills among the Respondents Exposed to Preferred Reflective, Inquiry-Based and Collaborative Approaches

High Order Thinking Skills	Reflective				Inquiry-Based				Collaborative			
	MD	SD	t-value	p-value	MD	SD	t-value	p-value	MD	SD	t-value	p-value
Analyzing	-24.90	5.53	-25.06	0.00	-25.68	7.21	-19.82	0.00	-22.45	7.06	-17.72	0.00
Evaluating	-24.13	6.41	-24.52	0.00	-24.52	6.99	-19.82	0.00	-28.65	8.83	-18.06	0.00
Creating	-32.13	2.63	-27.87	0.00	-27.87	5.80	-19.82	0.00	-27.87	6.06	-25.59	0.00

** Same legend in the previous table is used to interpret table 8.*

Table 8 explicates that after the employment of reflective approach of the respondents, among the sub-skills in high order thinking skills, the creating as sub-skill had impressively marked significant difference with a mean difference -32.13 and t-value of -27.87 respectively. Nonetheless, all the p-values of the sub-skills in high order thinking skills in the group exposed to reflective approach are all lower than 0.05 making the mean pre-test and post-test scores significantly different. It was revealed that the mean differences of each sub-skill such as analyzing, evaluating and creating have minute differences in terms of values as -25.68, -24.52, and -27.87 p< 0.05 level of significance. This proposes that inquiry-based approach is also an effective approach in enhancing the high order thinking skills of the students specifically the creating sub-skill of the learners. The same claim is supported by Salcedo (2016). She suggested that the learners become responsible in their own mental growth as inquisitive thinkers as they work towards discovery of the concepts behind the activities and experiments provided which is one of the characteristics of inquiry-based approach. Hilario (2015) added that teachers must introduce new discovery teaching strategy that could be associated with demonstrations and hands on activities that are accountable in strengthening the HOTS or higher order thinking skills of the learners. The table also provides the extent of the mean difference between the pre-test and post-test scores of the respondents exposed to collaborative approach. With the mean differences of -22.45, -28.65 and -27.87 for analyzing, evaluating and creating, it can be inferred that there is a big difference between the performance in the pre-test and post-test of the respondents as being exposed to collaborative approach. These values acclaim that

collaborative approach is also preeminent in enhancing the high order thinking skills of the respondents including all its sub-skills. Collaborative approach is not only limited in enhancing the LOTS of the learners but indeed as well as the HOTS of the learners.

3. Difference among the mean post-test scores of the three groups of respondents in terms of low order thinking skills

Table 9
Test of Difference in the Mean Post-Test Scores in Low Order Thinking Skills of the Respondents Exposed to the Preferred Reflective, Inquiry-Based and Collaborative Approaches

High Order Thinking Skills (HOTS)		Mean Square	f-value	p-value
Analyzing	Between Groups	43.422	2.078	.131
	Within Groups	20.900		
Evaluating	Between Groups	17.004	.603	.550
	Within Groups	28.216		
Creating	Between Groups	164.803	6.901	.002
	Within Groups	23.880		

Legend: p<0.05 Significant **p>0.05 Not Significant*

Table 9 confirms the test of difference among the low order and high order thinking skills of the respondents exposed to the preferred reflective, inquiry-based, and collaborative approaches. For the remembering sub-skill, it can be inferred based from the data above that three groups exposed to different approaches-reflective, inquiry-based and collaborative have significant differences among their post-test performances having a p value less than 0.05.

Comparing the groups' performance vis-à-vis understanding as sub-skill of low order thinking skills, the three groups exposed to the three approaches mark no significant difference with 0.001 at p<0.05. Thus, the three groups have comparable performance in their post-test underlying applying sub-skills. This may entail that on the remembering and understanding sub-skills, the learners exposed to the three approaches have comparable performances after the inclusion of activities which are exploratory, collaborative, and reflective in nature. The use of hands-on activities resulted in significant improvements in academic performance. Learners are curious and eager to learn. When the teacher fits the learning environment to learners' interests and needs, they become highly motivated. Therefore, it can be confirmed that the employment of collaborative, inquiry-based and reflective approaches during discussion embarked and aided the students to easily recall and understand the lesson well. Learners learn best through active involvement with concrete experiences.

Table 10
Test of Difference in the Mean Post-Test Scores in High Order Thinking Skills of the Respondents Exposed to the Preferred Reflective, Inquiry-Based and Collaborative Approaches

Low Order Thinking Skills (LOTS)		Mean Square	f-value	p-value
Remembering	Between Groups	158.968	5.752	.004
	Within Groups	27.638		
Understanding	Between Groups	190.891	7.138	.001
	Within Groups	26.741		
Applying	Between Groups	26.749	.989	.376
	Within Groups	27.059		

Legend: p<0.05 Significant **p>0.05 Not Significant*

Table 10 shows the differences in high order thinking skills, sub-skills of the three groups exposed to preferred active learning

approaches as to reflective, inquiry-based and collaborative. Although all the three approaches inclined the respondents to achieve well in each of the learning episode, the post-performance scores of the three groups in analyzing and evaluating marked no significant difference to each other with p values greater than 0.05. Contrary to creating sub-skill of the HOTS, with p value of 0.00 which is less than 0.05 which suggests that there is a significant difference among the performances of the three groups. The data may further indicate that the three groups have comparable performances as verbalized by their post-test scores in the analyzing and evaluating sub-skills of the LOTS. However, in creating sub-skill the groups inscribed differences, thus one group perform better than the other. This may be due to the different sets of learning activities in each of the approaches. The learners in the reflective group are given the chance to reflect on their strengths and weaknesses on a particular topic through different reflective logs and journals that enable them see the importance of monitoring their performances aside from the assessment and exercises given to them.

CONCLUSIONS

Based on the significant findings of the study, the following conclusions are drawn:

1. Three preferred active learning approaches of the respondents are collaborative, inquiry-based, and reflective.
2. There is a significant difference existing among the mean pre-test and mean post-test scores of the three groups as to low order thinking skills and high order thinking skills.
3. There is a significant difference on the remembering and understanding sub-skill of the LOTS of the three groups on the post-tests.
4. There are no significant differences in the performances of the groups in terms of applying sub-skills of the three groups.
5. In terms of high order thinking skills, there are no significant differences on the analyzing and evaluating sub-skills of the three groups, while the creating sub-skill of the three groups have significant differences among each other after exposing the respondents to the learning approaches.
6. Remembering and understanding sub-skills in lower order thinking skills is greatly enhanced using collaborative approach.
7. The creative sub skill of higher order thinking skills is improved prominently in reflective approach as revealed by the gathered data.

RECOMMENDATIONS

Based on the findings and conclusions obtained in the study, the following recommendations are hereby suggested:

1. Senior high school teachers may further enrich the 2C-2I-1R approaches to improve the thinking skills of the leaners.
2. Future researchers may conduct parallel study in a larger group with equally matched capabilities. They may also try another indicator of academic performance of the learners like the process skills in science or other skills in other disciplines. They may also pursue study that will tests the thinking skills of the learners using other active learning approaches not tested in the study.

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