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THE EFFECTS OF USING HARMONISED LEARNING ACTIVITIES IN CHEMISTRY ON STUDENT'S ACADEMIC PERFORMANCE AND CRITICAL THINKING SKILLS

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ABSTRACT

Improving educational outcomes requires concentrated efforts and part of the solution involves helping students to improve their critical thinking skills. This study focused on the effects of the developed harmonised learning activities in selected topics in Chemistry on the students academic performance and critical thinking skills. This quasi-experimental design involved one hundred fifty (150) junior high school students and twenty (20) science teachers from six public schools in Liliw, Magdalena and Majayjay, Laguna. The activities were carried out for three months simultaneously in the participating schools. The level of students academic performance was measured and evaluated using the mean standard deviation and T-test.

Research findings showed that the level of acceptability of the harmonised learning activities in selected topics in Chemistry in terms of objectives, content, and activities are extremely acceptable. The level of performance in the experimental group has a verbal interpretation of "did not meet expectation" in terms of pre-test. In terms of post-test the level of students' performance in the experimental group have a verbal interpretation of "very satisfactory". The null hypothesis tested at 0.05 level of significance indicated that there is a significant difference between the students' performance on pre-test and post-test of the experimental group. This means that the harmonised learning activities influenced the students' performance positively; it is an effective tool that enhances, improves and fortifies the critical thinking skills of the students. School administrators may encourage teachers to produce self-made instructional materials which in turn will help improve the quality of education.

KEYWORDS: ***harmonised learning activities; critical thinking skills and academic performance***

1. INTRODUCTION

Science Education is one of the key components of the K to 12 Curriculum which has faced a number of challenges relative to the achievement of the target competencies (Condino, 2019). Based on the National Achievement Test result on students' aptitude as reported (Andrada, 2012) science area continues to be one of the most difficult fields in basic education. These results tend to guide the Department of Education in searching for interventions to improve the quality in public schools and to provide appropriate learning tools for the learners.

There are several factors affecting Filipino student performance in science such as number of teachers and training attended, learning process, instructional materials, curriculum, administrative support, and funding (May-as, 2014). The quality of learning materials also influences student accomplishments and practice of process skills. Teachers must strive to adapt to students' level of knowledge and needs by making innovations on the learning materials and strategies that will be easily understood by a variety of learners (Martinez, 2016).

Critical thinking skills envisions the development of the students scientifically, technologically, and environmentally literate and productive members of the society who are critical problem solvers, responsible stewards of nature, innovative and creative citizens, informed decision makers, and effective communicators (Wong (2013).

2. PURPOSE OF THE STUDY

The purpose of the study is to develop harmonised learning activities in Chemistry and find out its effects on the junior high school student's academic performance and critical thinking skills.

3. LITERATURE REVIEW

A key feature of effective teaching is the selection of learning materials that meet the needs of students and fit the constraints of the teaching and learning environment. Teachers should be encouraged to develop instructional / learning materials specifically on topics which are abstract that contain practical application of concepts and principles (Gonzales, 2015). Lev Vygosky viewed that instructional materials have the capacity to develop student's level of thinking (low-highest), and can be used in problem solving activities (Cherry and Lehman, 2019). The selection of teaching tools is a crucial determinant of the degree to which the anticipated cognitive learning outcomes of an academic course are realised. Therefore, one major task that any instructor must undertake is to select the optimal combination of teaching methods that will help them and their students in the best way possible achieve the anticipated

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cognitive learning outcomes of the course. As such, choosing optimal teaching tools can be a greatly effective course of action to enhance learning in the classroom (Edalati, 2016).

Killen (2015) stated that teachers can design activities which will cater to varied levels of student performance. Jimenez (2014) in his study revealed that not all of the learning competencies are fully acquired by the students; thereby he recommended an intervention program to improve their level of competence. Since not one instruction fits all, teachers may customise activities based on the student's needs. Teachers should be creative in teaching the learners so that the lesson will be more interesting and retain in the mind of the students (Mendoza, 2018).

Relevant and meaningful activities which engage students and connect prior knowledge result in a long-term memory stage (Vergara, 2016). As stated by Bacay (2012) activities are done during the application of concepts to enable students to master and improve their performance and be able to identify the correct areas that are being improved.

4. METHODOLOGY

4.1. Preparation of the Harmonized Learning Activities Using the ADDIE Model (Analysis, Design, Development, Implementation and Evaluation)

4.1.1. ***Analysis Stage***

Assess the learning characteristics and needs of the target student respondents to determine the overall goals and produce the learning material that will address the student level of abilities.

4.1.2. Design

Identify the learning objectives, create activities, practice exercises and assessment aligned in the DepEd curriculum guide for junior high school students. Outline the content and teaching strategies to match the learning goals which were carefully made to enhance the student's needs and interests.

4.1.3. Development

Create the appropriate learning material using lecture, slides, animations, graphics, video, audio, photographs and other tools. Upon completion of the required materials make sure each topic was kept harmonised with the learning objectives.

4.2. Implementation

One hundred fifty (150) junior high school students were included as student respondents and twenty (20) Science teachers from different schools in Liliw, Magdalena and Majayjay, Laguna assessed the validity of the harmonised learning activities in Chemistry which included Liliw Senior High School (4) teachers, Liliw National High School (4) teachers, Nagcarlan Senior High School (5) teachers Magdalena Integrated High School (2) teachers, Sta. Catalina National High School (3) teachers and Suba National High School (2) teachers.

4.3. Evaluation

The harmonised learning activities were utilised by one hundred fifty (150) junior high school students from six public schools in Liliw, Magdalena and Majayjay, Laguna.

***4.3.1. Pre-tes*t.** All students took the fifty (50) item multiple choice test questions based from the learning competencies.

4.3.1.2. Actual use of the learning material. The harmonised learning activities were utilised for the one quarter lessons.

4.3.1.3. Post-test. At the end of the lesson, all students took the post-test which was identical to the pre-test.

4.4. Treatment and analysis of Data. The data collected was subjected to the appropriate statistical treatment followed by the interpretation of the results and findings.

5.RESULTS AND DISCUSSION

The corresponding analysis and interpretation of the tabulated data were presented in the following tables.

5.1. Level of Acceptability of the Harmonized Learning Material

Tables 1 to 4 show the level of acceptability of the harmonised learning material as assessed by the teacher respondents in terms of its objectives, content, and activities.

Table 1. Level of Acceptability of the Harmonized Learning Material in Terms of Objectives.

Statement	Mean	Standard Deviation	Remarks
1. Specific and simple	4.90	0.31	Strongly Agree
2. Measurable and attainable	4.85	0.37	Strongly Agree
3. Reliable and time bound	4.90	0.31	Strongly Agree
4. Suited to the needs of the students and teachers	4.85	0.37	Strongly Agree
5. In line with the learning competencies in the K to 12 Curriculum	5.00	0.00	Strongly Agree
Weighted Mean	**4.69**	**0.54**	**Extremely acceptable**

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Legend:

Point	Range	Remarks	Verbal Interpretation
5	4.21 – 5.00	Strongly Agree	Extremely Acceptable
4	3.41 – 4.20	Agree	Very Acceptable
3	2.61 – 3.40	Moderately Agree	Moderately Acceptable
2	1.81 – 2.60	Disagree	Slightly Acceptable
1	1.00- 1.80	Strongly Disagree	Not acceptable

The overall mean of 4.69 indicates that the objectives of the harmonised learning material in selected topics in Chemistry was extremely acceptable. Thus, the teachers strongly agree that the objectives of the material are relevant to the learner's need and it can be used as an effective learning tool. On the other hand, the objectives of the Harmonized Learning Material is in line with the learning competencies of the K -12 Curriculum with (M = 5.00, SD = 0.00)

As observed in the developed learning material, the objectives can be specific, simple, reliable, time-bound, and in line with the set competencies, but there would be a challenge on how would it be measurable and attainable as well as suited to the needs of the students and teachers; in a way that sometimes the teaching-learning process must adapt with the schedule set by the learners and the school.

It was supported by the studies made by Burns (2010); Alelaimat (2012) and Vergara (2017) that the content of the learning material should fit to the learning objectives; congruent to the previous and present lesson; communicate in specific, behavioural languages which will give direction to class discussion.

Table 2. Level of Acceptability the Harmonized Learning Material interims of Contents

Statement	**Mean**	**Standard Deviation**	**Verbal Interpretation**
1. suitable, interesting, current and up to date	4.85	0.37	Strongly Agree
2. contributes to the acquisition of concepts and understanding of the lesson	4.85	0.37	Strongly Agree
3. has information appropriate to the level of comprehension of the students	4.85	0.37	Strongly Agree
4. has correct sequence and progression	4.90	0.31	Strongly Agree
5. is clear enough to be taken up for specific material	4.85	0.37	Strongly Agree
Weighted Mean	**4.66**	**0.56**	**Extremely Acceptable**

Legend:

Point	Range	Remarks	Verbal Interpretation
5	4.21 – 5.00	Strongly Agree	Extremely Acceptable
4	3.41 – 4.20	Agree	Very Acceptable
3	2.61 – 3.40	Moderately Agree	Moderately Acceptable
2	1.81 – 2.60	Disagree	Slightly Acceptable
1	1.00 – 1.80	Strongly Disagree	Not Acceptable

The overall mean of 4.66 indicates the level of acceptability of the harmonised learning material in selected topics in Chemistry in terms of content that was interpreted as extremely acceptable. The teachers commented that the content of the harmonised learning material has correct sequence and progression with (M = 4.90, SD = 0.31).The material contains information appropriate and suitable to the learners.

As stated in the DepEd Manual Chapter 4 Section 3.3 (2013); learning materials should be properly planned, selected and utilised. Salcedo (2016) recommended the use of instructional materials to make the lesson explicit to the learners.The findings were in congruent with those of Tagala (2010) and Francisco (2019) that the content must meet the interest, knowledge, understanding, abilities, needs, and experiences of the students.

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Table 3. Level of Acceptability of the Harmonized Learning Material in terms of Activities

Statement	Mean	Standard Deviation	Remarks
1. Congruent to the objectives of the lesson	4.90	0.31	Strongly Agree
2. Answers the expected outcome of the content	4.90	0.31	Strongly Agree
3. Has information appropriate to the level of comprehension of the learner	4.90	0.31	Strongly Agree
4. Has correct arrangement and development	4.90	0.31	Strongly Agree
5. Is clear enough to be taken up for specific method	4.85	0.37	Strongly Agree
Weighted Mean	**4.68**	**0.62**	**Extremely Acceptable**

Legend:

Point	Range		Verbal Interpretation
5	4.21 – 5.00	Strongly Agree	Extremely Acceptable
4	3.41 – 4.20	Agree	Very Acceptable
3	2.61 – 3.40	Moderately Agree	Moderately Acceptable
2	1.81 – 2.60	Disagree	Slightly Acceptable
1	1.00 – 1.80	Strongly Disagree	Not Acceptable

Table 3 reveals that in terms of activities presented by the harmonised learning material has an overall rate of extremely acceptable with an overall mean of 4.68. The teachers strongly agree that the Harmonized Learning Material is congruent to the objectives of the lesson. The activities contain information suitable for the learners. The expected outcome based on the content, has information appropriate to the level of comprehension of the learner and has correct arrangement and development with (M = 4.90, SD = 0.31) and clear enough to be taken up for specific methods with (M = 4.85, SD = 0.37). The learning tool made by the researcher is found extremely acceptable in terms of its activities which can be used to improve the teaching-learning process.

McMillan (2011) and Turger (2014) stated that activities should be meaningful and customised based on student's needs to enhance their engagement into active, constructive, intentional, authentic and cooperative ways to improve their academic performance. As such, learning will be more engaging as the learners could see the connection between the lessons to their personal perceptions (Andrada, 2012) and (Bantoc, 2014). Their findings were supported by Wong (2013) in his study that enables the development of scientifically, technologically and productive members of the society who are critical problem solvers, innovative and creative citizens.

Table 4. Level of Student's performance in experimental group in Terms of pre-test and post-test

Test	Lowest Score	Highest Score	Mean	SD	Verbal Interpretation
Pre-test	10	17	13.25	1.864	Fair Satisfactory
Post test	30	40	35.95	2.112	Very Satisfactory

Legend:

Scale	**Verbal Interpretation**
40 - 49.99	Outstanding
30 - 39.99	Very Satisfactory
20 - 29.99	Satisfactory
10 - 19.99	Fairly Satisfactory
0 - 09.99	Did not meet expectation

Table 4 shows the level of student's performance in the experimental group in terms of pre-test and post-test. Out of 40 students, in their pre-test, the lowest found score is 10 while in the post test, it rises to 30. The highest score in pre-test is 17 and, in the post, test increases to 40. The students showed fairly satisfactory performance in the pre-test (M=13.25, SD= 1.864).

Post-test, obtained the (M=35.95, SD= 2.112) verbally interpreted as very satisfactory. This means that the use of the

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self-made materials of the teacher produces significant change on the performance of the students.

The findings of Torrefranca (2017) and Delucchi (2014) revealed that through the use of pre-test and post-test design a significant change was observed after the use of instructional modules; that pretest-posttest tool once put into practice allows the teachers to see if what is being covered in the lesson or unit is already mastered. Pre-test help measure true learning; pre-test can give students a preview of what will be expected of them. This help students begin to focus on the key topics that will be covered (Kelly, 2017).

Table 5. Difference between the students' performance of the Experimental group in their pre-test and post test

Achievement	t-value	t-critical	p-value	Analysis
Pre-test and Post test	-55.994	2.023	0.0000	Significant

Table 5 presents the difference between the students' performance on pre-test and post test of the experimental group. The data were statistically treated using the t-test of two sample means. The performance in pre-test is paired to the performance in post-test. The p value of 0.0000 which is less than the alpha value of 0.05 signifies that there is a significant difference in the performance of the students.

It shows that the harmonised learning material helps the students to perform better and improve critical thinking skills. Schalich (2015) found that by comparing pre-test and post test the teachers can see what students actually learned from the lessons that were developed. students master and improve their performance and be able to identify the correct areas that are being improved. The results revealed that the harmonised learning material was found to be effective in teaching Chemistry. The use of the tool influences the academic performance and enhances the critical thinking skills of the students in the classroom positively.

6. CONCLUSION

Based on the findings of the study, the following conclusion was drawn:

The null hypothesis tested at 0.05 level of significance is rejected, which indicates that there is significant difference between the pre-test and post-test of the experimental group. The use of harmonised learning activities in science which can help to boost the student's critical thinking skills is offered for educators making them a cognitive guide of the learner's learning.

7. RECOMMENDATIONS

In view of the findings and conclusion stated in the study, the following recommendations are proposed; (1) School administrators should encourage the teachers and other practitioners to give a greater importance to the use of harmonised learning materials in teaching least learned Science concepts. By doing this, the learners are not passive recipients of information, but they actively construct their knowledge in interaction with the environment and through the reorganisation of their mental structures. (2)The school administrators may support the teachers by providing additional seminars and training on the production of self-made instructional materials and other teaching strategies that will fit to the learner's needs. This will develop the teaching and learning process and in turn help improve the quality of education. (3)School heads may motivate the science teachers to utilise the harmonised learning activities to enhance the student's process and skills. This will enable the student's to be given an opportunity to explore chemistry in their own preference style.

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