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Research Article

Improved Conceptual Understanding in Learning Biology through Localized and Contextualized Learning Activities

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ABSTRACT

Nowadays, a relatively large number of high school students have poor learning performance in Science which affects their academic performance and even the school National Achievement Test (NAT) result. This study determined the effectiveness of the localized and contextualized learning activities in improving the conceptual understanding of tenth-grade students in learning Biology for the Third Quarter of the School Year 2019-2020. The study was conducted using the pretest-posttest quasi-experimental design involving sixty (60) student-participants in a public secondary school in the Division of Surigao del Sur, Mindanao, Philippines. This study employed an intact group sampling technique in selecting the participants into two groups, the control group (conventional learning material/learning activity sheets) and the treatment group (localized and contextualized learning activities). The findings of the study revealed that the post-test mean score of the treatment group is greater than the post-test result of the control group. Also, there was a significant difference in the conceptual understanding of the students in the control group and treatment group. It shows that localized and contextualized learning activities promote a better understanding of the lesson. Hence, future study is suggested to develop and produce localized and contextualized instructional materials such as modules and worksheets for other learning competencies in Science.

Keywords: *Localized and contextualized learning activities, conceptual understanding, Biology, science education*

Introduction

Science is among the valuable subject areas in the field of global education. However, science education constantly changed in terms of curriculum design and approach (Rogayan & Macanas, 2020) to embrace the competitive

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world of innovation and advanced education. Hence, the challenge nowadays among educators is that they should be adaptive and flexible in embracing the trends of 21st-century challenges. These challenges drive all the schools and teachers to find effective ways of addressing the needs of the learners through the conduct of research or by implementing innovative and creative interventions in teaching Science. Sadly, despite several interventions introduced in science education, the quality and quantity of instructions remained a threat to the Philippine educational standards (Linog et al., 2013; Montero, 2018). Globally, the Philippines lags with other countries in terms of quality education. According to the Program for International Student Assessment (PISA) results in 2018, the Philippines ranked 77th in Science out of 78 participating countries in the whole world (OECD, 2018). The trend also in the annual results of the National Achievement Test (NAT) disclosed poor performance in Science among schools in the Philippines. Along with these pressing issues, many schools still have limited access to instructional resources that hamper the quality of teaching and learning.

The question of how to improve the quality of teaching and learning has been a perennial issue for several years. Thus, to make the competencies extremely important, interesting, and helpful to the learner's daily activities, one of the Department of Education's mandates is to localize and contextualize the lesson (Department of Education, 2016). The Philippine Republic Act 10533 under section 10.2 states that the "*curriculum shall be contextualized and global and shall be flexible enough to enable and allow schools to localize, indigenize, and enhance the curriculum based on their respective educational and social contexts*" (Official Gazette, 2013). This notion emerged as a strategy to address the existing issues and challenges in achieving the goal of quality education in the Philippines (Ballesteros, 2016).

According to Giamellaro (2014) and Spring (2010), contextualization is a process that draws the connection between the content knowledge and real-life situations that the learners are familiar with based on their past experiences. On the other hand, localization is about addressing the local needs by adopting, adjusting, or relating the content of the curriculum to the local environment and cultural perspective of the community (Taylor, 1998; Ballesteros, 2016). According to Bringas (2014) and Perin (2011), localization encourages the utilization of materials, activities, events, and issues that are locally present in the environment. These allow the learner to learn easily by relating the lesson in the context of their local places, culture, and resources that are closed to their mindset and experiences (Tinog, 2018). Hence, localization and contextualization make science lessons very relevant and responsive to the needs of the learners.

Since the Philippine K to 12 Curriculum embraced the No Child Left Behind Policy (UNESCO, n.d.) along with the implementation of Education For All (EFA) (Philippine Education For All, 2015), therefore, this study endeavored to look for a strategy that would cater the learning needs of Filipino learners in learning Science. Even though the contribution of localization and contextualization in education had been proven in the previous literature, few studies had been documented that deals with localized and contextualized learning activities in addressing competencies in Science. Thus, this provides the main focus of the present investigation to utilize the localized and contextualized learning activities to explore their effectiveness in improving the conceptual understanding of the students in learning Biology for Grade 10 Science. Specifically, this study sought to answer the following objectives:

1. Determine the level of conceptual understanding of the respondents before and after employing the conventional learning material (learning activity sheets) and the localized and contextualized learning activities in Science.
2. Examine the significant difference between the control group and treatment group in pre-test and post-test.
3. Examine the significant difference between the pre-test scores and post-test scores of the control group and the treatment group.

Null Hypotheses

H_{O1}: There is no significant difference between the control group and treatment group in pre-test and post-test.

Ho_2: There is no significant difference between the pre-test scores and post-test scores of the control group and the treatment group.

Scope and Limitation

The present study focuses on the utilization of localized and contextualized learning activities as a strategy for improving the conceptual understanding of Grade 10 students in learning Biology. The prime subjects of this study are the Grade 10 students handled by the researcher at San Miguel National Comprehensive High School, Magroyong, San Miguel, Surigao del Sur, Mindanao, Philippines.

This study is limited only to the selected competencies covered by the first module of the Third Quarter (e.i. Nervous System, Endocrine System, Reproductive System, and Negative Feedback Mechanism). The present study employed the two-pretest-posttest quasi-experimental design. The learners under the control group were exposed to conventional learning material/learning activity sheets, while the experimental group was treated with the use of localized and contextualized learning activities. During the implementation of this study, the researcher employed the pre-test assessment before the intervention was conducted, and the post-test assessment after the intervention was introduced to the participants. The duration of the intervention lasted for one month in November of the School Year 2019-2020.

Methods

Research Design

This study utilizes the quasi-experimental design using the two-group pretest-posttest design in conducting action research. The identified Grade 10 students were pre-tested and exposed to the intervention, and then post-tested after the intervention was employed on them (Rasool, 2012). In this study, the treatment group was composed of the learners who were exposed to localized and contextualized learning activities, and the control group is taught with the use of conventional learning material.

Respondents of the Study

The participants of the study were regular Grade 10 students enrolled at San Miguel National Comprehensive High School, Magroyong, San Miguel, Surigao del Sur, the Philippines for the School Year 2019-2020. A total of sixty (60) student-participants belonging to the heterogeneous class were exposed to the quasi-experimental research prepared by the researcher. In this study, an intact group sampling technique was employed in the selection of the participants. The number of student-participants was based on the number of students who did not refuse to volunteer as part of the study. Hence, there were 30 students exposed to the control group (conventional learning material/learning activity sheets) and 30 in the treatment group (localized and contextualized learning activities).

Validation of Localized and Contextualized Learning Activities

The learning activities employed in this study were adapted from the DepEd Science 10 Learner's Material which was modified by the researcher to localize and contextualize to fit the needs of the learner. These learning activities had undergone thorough validation of the three (3) identified science content validators who have experience in localizing and contextualizing learning resources. The evaluation tool of Marasigan (2019) was utilized for the validation of the localized and contextualized learning material. This tool consists of the following criteria: suitability of objectives, content and layout, the suitability of approach, level of difficulty, and overall effectiveness. The suggestions and comments made by the validators served as input for the improvement of the said learning activities.

Research Instrument

A teacher-made questionnaire was employed to assess the conceptual understanding of the learners of the selected Biology competencies. This served as an assessment tool in conducting an assessment before and after applying the conventional learning material/ learning activity sheets and the localized and contextualized learning activities. The said questionnaire is a multiple-choice type of test

consisting of fifteen (15) items. These questions also were formulated with an emphasis on Bloom's Taxonomy on Higher Order Thinking Skills (HOTS). This instrument had undergone thorough validation at DepEd-Surigao del Sur Division during the Division Writeshop in Crafting Test Questions. Moreover, Kuder Richardson Formula 20 was utilized to determine the reliability of the constructed items after the pilot testing was conducted. The Biology competencies covered by the pre-test and post-test assessment involved the Nervous System, Endocrine System, Reproductive System, and Negative Feedback Mechanism.

Data Collection

The researcher asked the approval from the school principal to conduct action research. After the letter was approved, the researcher asked permission from the students and parents to conduct action research. Afterward, a pre-test assessment was done before the implementation of localized and contextualized learning activities. Four (4) Biology competencies under the Third Quarter were taught the same to the two identified sections (control and treatment group). The treatment group received instruction from the researcher using locally relevant and contextualized learning activities, while the control group received instruction using traditional learning materials/learning activity sheets (control group). On the final day, a post-test evaluation was carried out to determine the effectiveness of the intervention after the administration of the validated learning activities. The scores of the students were held with utmost confidentiality to give respect, justice, and benevolence to the respondents. Finally, data were collected and recorded for data analysis.

Data Analysis

The test results of the Grade 10 students in this study were examined using descriptive and inferential statistics. The pre-test and post-test measurements between the control group and treatment group were compared using the mean, percentage, and standard deviation. To determine whether there was a significant difference between the pre-test and post-test scores of the two groups, a paired t-test sample was used. On the other hand, the significant difference between the sections' pretest and post-test results was examined using a t-test for the independent sample. The learning performance of the two groups was compared using these tests, which were run at a 0.05 level of significance (2-tailed). However, the calculator from the Social Science Statistics was utilized to test the effect size using Cohen's *d*.

Results

Table 1 shows the level of conceptual understanding of the respondents between the control and treatment groups based on their pre-test and post-test results.

Table 1. Pre-test and post-test learning performance of the control group (n=30) and treatment group (n=30)

Variables	Pre-test		Post-test		% Learning Gains
	Mean	SD	Mean	SD	
Control	5.13	1.59	9.53	1.46	29.33%
Treatment Group	4.70	1.68	11.63	1.61	46.20%

As revealed in table 1, grade 10 students in the control group *(M=5.13, SD=1.59)* and treatment group *(M=4.70, SD=1.68)* got a low score on their pre-test compared to the post-test results, which indicates that the majority of the respondents were not able to get the correct answer to the questions. It also shows that most of them do not have prior knowledge of the lessons before the intervention was introduced to them.

However, after the two groups were exposed to the interventions, they obtained a higher mean compared to their pre-test result. These signify that there is a high learning performance observed among the respondents. However, it can be noticed that the treatment group, which is the localized and

contextualized learning activities has a higher mean *(M = 11.63, SD = 1.61)* compared to the control group. These further explain that there were more learnings acquired by the students when the localized and contextualized activities were used in teaching Biology competencies; since the percentage of learning gains of the treatment group (46.20%) is higher than the control group (29.33%). As observed during the conduct of the study, the students taught with localized and contextualized learning activities showed enthusiasm. The passive students were participative as they do the given activity given to them by the researcher. Therefore, the findings of this study imply that by introducing activities that have a relevant connection to the student's daily-life experiences, students can grasp the competencies taught to them by their teacher.

Table 2. Group difference between pre-test and post-test of control group and treatment group

Variables	Mean	Mean Difference	Computed t-value	p-value	Effect size (Cohen's *d*)
Pre-test (Control)	5.13	0.43	1.024	0.310	0.26
vs					
Pre-test (Treatment)	4.70				
Post-test (Control)	9.53	2.10	-5.303	0.000*	1.37
vs					
Post-test (Treatment)	11.63				

*Note: *Significant at p < 0.05*

Table 2 shows the mean difference of 0.43 in the pre-test results of the control group and the experimental group in terms of the students' performance. Based on the statistical computation, it gained a t-value of 1.024, an effect size (Cohen's *d*) of 0.26 (small effect), and a p-value of 0.310 which is greater than at 0.05 level of significance. Therefore, the null hypothesis is accepted. This shows that there is no significant difference between the control group and treatment group in terms of the pre-test results. These imply that most of the students under the control and treatment group have the same prior knowledge before the interventions were introduced to them. In an independent sample t-test conducted to compare the mean scores in the post-test between the control group and the treatment group (Table 2), the mean difference of 2.10 in the post-test results between the control and treatment group got the computed t-value of -5.303, an effect size (Cohen's *d*) of 1.37 (very large effect) and with a p-value of 0.000 which is lesser than 0.05 level of significance. This shows that there is a significant difference in the post-test results between the control group and the treatment group. This implies that the conceptual understanding of the students in the treatment group is significantly different from the control group. These further indicate that those students who were exposed to localized and contextualize learning activities performed better than those students who were not treated with localized and contextualized learning activities.

Table 3. Mean scores difference between the pre-test and the post-test of control and treatment group

Variables	Mean	Mean Difference	Computed t-value	p-value	Effect size (Cohen's *d*)
Pre-test (Control)	5.13	4.4	-18.137	0.000*	3.31
vs	9.53				
Post-test (Control)					
Pre-test (Treatment)	4.7	6.93	-16.933	0.000*	3.09
vs	11.63				
Post-test (Treatment)					

*Note: *Significant at p < 0.05*

The pre-test and post-test scores in the treatment and control groups were compared using a paired sample t-test to see if there was any statistically significant difference between them. According to Table 3 results for the control group, the calculated t-value for this test was -18.137, with a Cohen's *d* effect size of 3.31 (a huge effect) and a p-value of 0.000. These demonstrate that the control group's post-test results are noticeably higher than their pre-test mean score. With a computed t-value of -16.933, an effect size (Cohen's *d*) of 3.09 (large effect), and a p-value of 0.000, which is smaller than the alpha value of 0.05, the treatment group likewise had a comparable result (Table 3). These findings show that both groups greatly outperformed their pre-test performance in the post-test. However, the treatment group's mean rise, which was found to be 6.93, was larger than the control group's mean increase, which was found to be 4.4.

Discussion

The present study explored the effectiveness of localized and contextualized activities in learning Biology competencies. The results demonstrate that the said learning activities used in teaching have a significant increase in the conceptual understanding of the subject matter. The result confirms the study of Ballesteros (2016), Garin et al. (2017), and Dioneda (2018) who applied science activities that are localized and contextualized. According to Ballesteros (2016), the improved performance is due to the favorable attitude of the students toward performing science activities when its concept is linked to the real-life context. In fact, during the administration of the localized and contextualized learning activities, students were noticed to have interest and participation to perform the assigned tasks. Mouraz and Leite (2013) cited that through contextualization, students will engage more in school tasks for they were taught in the context of the real-world application (Center for Occupational Research and Development, 2012). Furthermore, it was elucidated by Lee and Sakamoto (2012) that cultural contextualized education promotes motivation to the learners to learn because it allows them to appreciate and understand their cultural heritage. This implies that localization and contextualization of science activities arouse learners' interest; thus, resulting in the conceptual attainment of the science concept.

The present findings relate to the study of Yam (2005), who stressed the benefits of contextualized-based teaching and learning in developing a holistic understanding of the lesson. These add to the previous literature (Morales, 2017; Carmen et al., 2015; Yam, 2005) that localizes and contextualizes teaching and learning to provide the real picture of science as it boosts the students to give the significant connection of science to the rest of their lives. Lee and Lykx (2005) also stressed that when science is associated with the students' experiences, more students would be involved to perform the learning activity. This makes science not difficult and relevant to their lives.

In this study, the model-based constructivist theory was incorporated into localized and contextualized learning activities. These learning activities allow the students to perform the given activities (Amirnudin & Saleh, 2020) since it encourages them to apply their ideas and experiences to a new situation to construct new knowledge (Berns & Erickson, 2001; Williams, 2018; Gray, n.d.). In the control group, there were few activities provided wherein discussion-based teaching dominated in general. This resulted in a lack of interaction with the activities that made the students bored sometimes. According to Tularam and Machisella (2018), the conventional way of teaching using conventional learning material has little contribution to the conceptual understanding of the students. This simply implies that if more meaningful learning activities are to be given to the students, more learning would be acquired. This further demonstrates that localized and contextualized learning activities play a significant role in improving the conceptual understanding of the learners. Integrating this strategy in developing science activities may help realize the attainment of the learning competencies despite the limited access to other science learning resources. Hence, this study

would like to suggest developing and producing instructional materials such as modules and worksheets that are localized and contextualized to make the science curriculum flexible and responsive to the needs of the learners (De Lara, 2017).

Conclusion

The following can be inferred based on the findings of the study: The post-test results of the treatment group (localized and contextualized learning activities) are higher than the post-test results of the control group. This implies that localized and contextualized learning activity has significantly improved the students' conceptual understanding. Meanwhile, the significant results of the learning performance between the control group and treatment group manifest that the localized and contextualized material outsmarted the conventional learning material with no integration of localization and contextualization of biological concepts.

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