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Localized STEM Lesson in Teaching Biodiversity for Grade 8 Learners

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Abstract

This study aimed to develop a localized STEM lesson in teaching biodiversity for Grade 8 learners. The developed learning material would give students a thorough knowledge of the topic in terms of its meaning, applicability, and importance. It would be easier for them to understand the topic and reinforce their critical thinking abilities since the lesson is localized. The learning competencies outlined in the science curriculum guide were the foundation of this STEM lesson. The developed localized STEM lesson was evaluated by the experts in this field. Comments and suggestions of the evaluators were considered in improving the material. The learning material was rated as excellent in terms of learning objectives, learning content, degree of contextualization, and STEM lesson stages. Therefore, it is valid and acceptable instructional material as derived from the findings and analysis.

Keywords: STEM Education, biodiversity, local

1. Introduction

The Philippine educational system has undergone modifications to improve the quality of education and equip students with the necessary skills to face future challenges. Despite efforts to improve science achievement, poor results have persisted over the years, highlighting the need for curriculum enhancements in the country (Magulod, 2017). According to the 2019 Trends in International Mathematics and Science Study (TIMSS), the Philippines scored 297 and 249 in mathematics and science, respectively; this performance was the lowest among the 58 countries participating in the study (CNN Philippines, 2020). In the 2018 launch of the Programme for International Student Assessment (PISA), the Philippines obtained the lowest rank among 79 participating countries and economies in reading and the second lowest in science and mathematics (Juan, 2019). Almerino et al. (2020) posited that the primary reason for the poor

performance of Filipino students in science at the primary level is the inadequate science curriculum and the insufficient preparation of science teachers. In addition, the insufficiency of educational resources likewise contributed to the poor academic achievement of science students in the Philippines, underscoring the need for significant changes to the primary science curriculum in the country (Trinidad, 2020).

Hence, in order to meet the demands of the 21st century, STEM Education is increasingly necessary to be implemented into the curriculum. As an interdisciplinary approach to learning, it ensures the learners to acquire practical skills in Science, Technology, Engineering, and Mathematics. In this approach, there is a shift in focus from traditional teaching and learning methods to a more practical and hands-on approach that equips students with necessary skills to succeed in a world increasingly reliant on technology and innovation.

The K–12 Science curriculum emphasizes localization and contextualization as key components of lesson delivery. These concepts strongly stressed that students learn most effectively when they can relate what they are learning to real-world contexts and applications (Na-Songkhla et al., 2019). In-depth learning can be ensured by exposing students to the various learning opportunities and resources in the neighborhood or community and allowing them to interact with, relate to, and adjust to a real learning environment. Placing a lesson within the context of the prevalent local environment, culture, and resources aids teachers and students in understanding concepts; lessons become more relevant, suitable, and tailored (Bello et al., 2023).

Further, the study of biodiversity is crucial to STEM education because it gives students pertinent and applicable examples of how science and math can be used to solve problems in the real world. Goal #14: Life Below Water, one of the Sustainable Development Goals (SDGs) adopted by the United Nations in 2015, and biodiversity are closely related. "Conserve and sustainably use the oceans, seas, and marine resources for sustainable development" is the stated objective of this goal (Department of Economic and Social Affairs, n.d.). An important component of accomplishing this objective is biodiversity, which refers to the variety of living organisms that inhabit the earth, including marine species. Nutrient cycling, climate regulation, and recreational possibilities are just a few of the numerous ecological, financial, and societal advantages it offers. However, threats to marine biodiversity include overfishing, pollution, climate change, and habitat loss due to human activity have become very apparent. Thus, incorporating a localized STEM lesson on biodiversity can aid in developing useful skills such as data gathering and analysis, critical thinking, and problem-solving to address the problem. In fact, it offers a remarkable opportunity to involve students in practical learning activities that stress the real-world applications of science and mathematics. By studying biodiversity, students learn the complex connections between living things and their surroundings and how human activities may affect these relationships. To develop a localized STEM lesson plan, the literatures (Fachrunnisa et.al., 2021; Koes-H et.al., 2021; Ebal Jr et.al., 2019; Guarin et.al., 2019; Villaruz et.al., 2019) suggested some issues that could engage students to practice science and mathematics knowledge through developing the prototypes as a solution of the issues. Those studies adopted Sutaphan and Yuenyong (2019) STEM teaching approach for developing STEM education lesson plan.

2. Objectives of the Study

This study aimed to seek the following objectives:

1. To assess the needs of the school head, and science teachers to better teach the biodiversity topic

2. To develop a localized STEM lesson to aid learners in understanding the topic better

3. Methods

The following subsections describe the development of the localized STEM lesson on Biodiversity.

3.1 Needs Assessment Interview of the School Head and Science Teachers

To ascertain the needs for the localization of STEM lesson, the researcher adopted and modified the work of Jumawan (2022). Needs assessment interview questionnaires were given to the key informants. There were two (2) sections in the needs assessment questionnaire: the first one dealt with contextualization, while the second concentrated on STEM education. The findings of the interview were thematically analyzed.

3.2 Development of the localized STEM lesson on Biodiversity

In developing the localized STEM lessons on Biodiversity, several steps were carried out to align it with the K-12 curriculum and the pedagogical framework of the Context-Based STEM Education. Moreover, this study adopted the work of Tecson (2019) wherein the process comprised of (7) seven steps as shown in Figure 1 below.

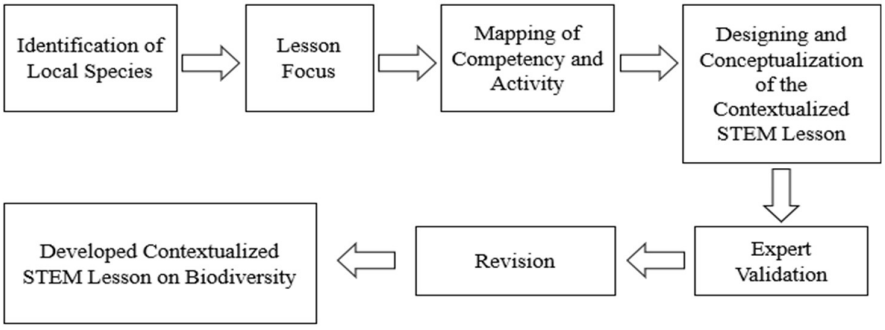

Figure 1. Development of the Contextualized STEM Lesson on Biodiversity (Tecson et. al., 2019)

The following stages were followed in developing the localized STEM lesson on Biodiversity:

3.2.1 Identification of Local Species.

Before developing the STEM lesson plan, the researcher collected species to be integrated in the localization of the lesson and activities. These were then identified and named by an expert. Images were taken with a phone camera to document the specimens.

3.2.2 Lesson Focus.

The lesson focus was based on the needs assessment interview result of the school principal and science teachers. This was conducted to know their points of view on the need to localize the lesson about Biodiversity.

3.2.3 Mapping of Competency and Activity.

The lesson and its activities included in the study were mapped with the learning competencies and standards of the K-12 Science Curriculum.

3.2.4 Designing and Conceptualization of the Localized STEM Lesson on Biodiversity.

In designing and conceptualizing the localized STEM lesson, the content, performance standards, and learning competencies were considered. The researcher adopted the STEM Education learning approach of Sutaphan and Yuenyong (2019) in developing the lesson plan. The following are the different stages of the STEM lesson plan.

3.2.4.1 Identification of Social Issues. During the initial stage, this was being investigated into for societal issues. The focus was placed on the lake's shoreline since the Maranao people attributed a lot of value to it. Unfortunately, there had been reports of eighteen (18) native fish species disappearing, and they were a significant source of food and income for the people living nearby (Mayuga, 2019). There was a call for a comprehensive strategy to successfully address several losses in the lake's biodiversity. In the activity, the current status of Lake Lanao was shown in images, and questions were provided to help the students' topic of discussion. During the discussion, which lasted about ten minutes, the student's observation and issues identified were shared. The value of showing real images in the delivery of lessons was heavily focused on localization and contextualization in the K–12 Science curriculum.

3.2.4.2 Identification of Potential Solution. This was followed by the identification of a possible solution. Students were given the task of building a diorama of an ecosystem that would address the identified social issue problem and offer potential remedies for the threat to Marawi City's maritime biodiversity. Biodiversity, which refers to the range of living organisms that inhabit the globe, especially marine species, is crucial to achieving this goal. Among the many ecological, financial, and sociological benefits it provides are nutrient cycling, climatic regulation, and recreational opportunities. However, overfishing, pollution, climate change, and habitat loss brought on by human activities are dangers to marine biodiversity (Department of Economic and Social Affairs, n.d.). These problems were identified in this activity and solutions were brainstormed. Once more, questions to guide were provided to facilitate the students' thought processes as they proposed solutions to the highlighted social challenges. A reflection paper on the value of biodiversity protection had to be written as well.

3.2.4.3 Need for Knowledge. In the third stage, referred to as the need for knowledge. Students learned the lesson based on the material that the researcher had provided. Information was provided on the notion of biodiversity, the classification of organisms using the hierarchical taxonomic system, and the level of high biodiversity's contribution to an ecosystem's stability. Additionally, two exercises that focused on categorizing organisms and protecting endangered species were prepared. Biodiversity research is essential to STEM education because it provides students with real-world examples of how science and math can be utilized to address problems (Department of Economic and Social Affairs, n.d.).

3.2.4.4 Decision-Making. The fourth stage focused on the decision-making aspect. In the third activity, specific tasks were completed including species identification, gathering and analysis of the identified species, and constructing ecological models. Given this, localized STEM lesson on biodiversity could help students gain practical abilities like data collection and analysis, critical thinking, and problem-solving. It presented an exceptional chance to engage students in hands-on learning activities that emphasize the practical applications of science and mathematics.

3.2.4.5 Development of Prototype or Product. Students built a 3D ecosystem model that depicted the survival of the species they had studied in the fifth stage of the lesson plan. This was captured and shared on social media sites with captions emphasizing the value of species conservation.

3.2.4.6 Test and Evaluation of Solution. In the sixth stage, questions were provided to guide to test and evaluate the solution. This included queries on how to sustain the identified endangered species effectively, what its effects are in real life, and whether the suggested approach proves to be feasible.

3.2.4.7 Completion and Decision Stage. Lastly, the project they created were posted on their Facebook accounts. They shared what they had learned from the activity and received input from their peers. In order to assess the caliber of the model and the efficacy of the action plan, self- and peer-assessment rubrics were also provided. The methods that could be offered to students as a way of arranging their actions should be emphasized in STEM topic teaching and learning. Through the steps, students would be encouraged to come up with ideas, carry out research and analysis, model their ideas, decide what they need, address problems, write about their experiences, and connect with one another (Sutaphan & Yuenyong, 2019).

3.2.5 Expert Validation.

The developed localized STEM lesson was evaluated and rated by STEM experts, and in-service teachers. It utilized the STEM rubric of Tecson (2019).

3.2.6 Revision. Following the procedure of validation was the revision.

The comments and suggestions of the evaluators were considered in improving the localized STEM lesson on biodiversity.

3.2.7 Developed Localized STEM lesson on Biodiversity.

The developed localized STEM lesson on biodiversity was used throughout the duration of the study.

LESSON DESCRIPTION

The presented lesson plan examines the concept of biodiversity, encompassing the levels of biodiversity, the classification and naming of organisms, and strategies to protect and mitigate the extinction of species. The primary focus of this lesson plan is to apply these concepts in the local context of Marawi City.

(a) (b)

Figure 2. Localized STEM lesson on Biodiversity (a) Cover Page (b) Lesson description

4. Results and Discussion

The needs assessment interview results were the bases of the development of the localized STEM lesson on biodiversity. This was evaluated by STEM experts, and in-service teachers through a STEM rubric of Tecson (2019). The following subsections were the results and discussion of the needs assessment interview of the key informants and the evaluators' rating of the developed learning material.

4.1 Needs Assessment Interview of the School Principal and Science Teachers to Develop a Localized STEM Lesson

The principal of the school and two (2) science teachers were among the respondents in a needs assessment interview. Tables 1 and 2 provided an overview of their answers regarding contextualization/localization of lesson and STEM education. To protect the privacy of the respondents, this study used data coding. NA-SP meant Needs Assessment: School Principal, and NA-ST1 meant Needs Assessment: Science Teacher 1.

Table 1. Summary of the Responses on Contextualizing/Localizing a Lesson on Biodiversity

Theme	Coded For	Quote
Familiarity of Contextualized/Localized Teaching	Contextualizing lessons and activities	**NA-SP:** "Yes, I have heard about contextualization of lesson. And I think, some teachers here in the school use this when teaching their lesson/subject." **NA-ST1, NA-ST2:** "Yes, I actually do this sometimes."
Trainings on Contextualizing/Localizing Lessons	Attended and Conducted Webinars/Seminars	**NA-ST1:** "I haven't. But I will attend if there's an opportunity." **NA-SP, NA-ST2:** "I haven't attended any seminar/webinar since pandemic happened."
Benefits of Contextualization/Localization in the Teaching-Learning Process	Authentic Learning Makes learning relevant	**NA-ST1:** "It will give students new ideas and experience authentic learning." **NA-ST2:** "Yes, because it can make learning more relevant."

The summary of the responses on contextualizing/localizing a lesson was shown in Table 1. It was comprised of themes on its familiarity, training, and advantages. The respondents expressed their familiarity with contextualized or localized instruction. However, none was able to attend any training on contextualizing or localizing courses. One of the respondents mentioned that it would provide students with authentic learning, and the other stated it would make learning more relevant. To support the above-mentioned information, the Department of Education (DepEd) has released a number of DepEd directives, including the DO No. 35, s. 2016. Under the leadership of the school administrator, teachers had the chance to take part in cooperative learning sessions to solve common difficulties faced by the school. This method of continual professional development is utilized in schools to improve teaching and learning as part of the K–12 fundamentals of education. Together, the teachers can contextualize the lesson and make it simple to understand for the students (Department of Education, 2016).

Table 2. Summary of the Responses on STEM Education

Theme	Coded For	Quote
Familiarity of STEM Education	As a Strand	**NA-SP, NA-ST1:** "What I know about STEM is, it is one of the strands in Senior High School."
Trainings on STEM Education	Attended and Conducted Webinars/Seminars	**NA-SP, NA-ST1:** "I haven't attended. If there is a chance, I would be thrilled to attend."
Benefits of STEM Education in the Teaching-Learning Process	Realistic Examples Active Participation	**NA-ST1:** "It gives realistic examples to the students." **NA-ST2:** "It promotes active participation of the students."

The summary of the responses on STEM education was presented in Table 3. As shown above, none of the respondents was able to attend any webinars or seminars that were being held. They were also unfamiliar with STEM education yet had known it only as a strand. This was important to address because one of the benefits highlighted in the literature was that STEM education gave students real-world examples and encouraged their active participation. STEM Education is becoming more important to be incorporated into the curriculum to meet the demands of the 21st century (Trinidad, 2020). The processes that students could be given to organize their actions should be emphasized in STEM topic teaching and learning. Students may also learn a number of adaptable skills, such as critical thinking, cooperation in group projects, time management, interacting with people and encouraging them (Sutaphan & Yuenyong, 2019). In turn, these skills could help them be successful in discovering solutions or developing prototypes or products.

On the other hand, a summary of the responses received during the science teachers' needs assessment emphasized contextualizing the teachings or exercises to allow students to grasp the lesson faster. However, due to different teaching approaches, a shortage of resources, and the absence of opportunities to discuss this topic in seminars, a lack of application and implementation of this strategy was observed. They commonly taught in a traditional manner because the school lacked the necessary tools and resources for learning. Traditional methods of teaching and learning were being replaced by ones that were more practical, hands-on that provided students the skills they needed to succeed in a society that was more dependent on technology and innovation (Trinidad, 2020). The lack of educational resources had a role in the poor academic performance of science students in the Philippines, highlighting the necessity of significant revisions to the nation's basic science curriculum. If given the chance, the science teacher respondents were interested in participating in webinars or seminars on this subject. Similar to the definition of the school principal, a strand in the curriculum was used to describe STEM education for science teachers. Their unfamiliarity with the STEM education was also expressed. Despite their lack of knowledge with STEM education, the teachers stated their desire to attend conferences and webinars on this topic. According to Almerino et al. (2020), the inadequate science curriculum and the inadequate preparation of science educators were the main causes of the low performance of Filipino pupils in science at the primary level.

In summary, the science teachers and the principal were aware of the benefits of contextualization/localization of lesson and how it would help students acquire the knowledge on the subject matter faster; nonetheless, they still frequently taught in a traditional way because the school lacked the resources and tools needed for learning. No webinars nor seminars on STEM education were also made available that could have been useful for teaching biodiversity using a contextualized or localized STEM lesson plan. In that regard, poor outcomes had continued over time despite initiatives to raise

science achievement in education. This highlighted the need for curriculum adjustments across the nation (Magulod, 2017). Hence, including a localized STEM lesson in the curriculum could help students gain practical abilities and enhance their skills.

4.2 Validation of the Developed Localized STEM Lesson on Biodiversity by the STEM Experts, and In-Service Teachers

The developed localized STEM lesson plan was evaluated by two (2) STEM experts and two (2) in-service teachers through the STEM rubric of Tecson (2019). Their comments and suggestions were considered for the betterment of the learning material. The distribution of ratings for each of the adopted STEM rubric's criteria was presented in Table 3.

Table 3. Summary of Experts' Rating of the Developed Localized Biodiversity STEM lesson

Components	Mean	Description
Learning Objectives	3.67	Excellent
Learning Content	3.67	Excellent
Degree of Contextualization	3.81	Excellent
STEM Lesson Stages	3.96	Excellent
Overall rating	3.78	Excellent

The learning objectives, content, degree of contextualization, and STEM lesson stages were the components in rating the developed localized STEM lesson. The learning objectives received an average rating of 3.67, the learning content received 3.67, the contextualization level received 3.81, the STEM lesson stages received 3.96, and the total rating received 3.78. All of which were given a description of excellent in which its mean interval corresponded to values of 3.25 - 4.00. This demonstrated that the developed STEM lesson on biodiversity had a guaranteed level of quality as an instrument in this study. In order to produce successful classroom leaders who could stay current with current improvements in STEM education teaching and apply that information to good student teaching, the growth of STEM-based learning must be supported and maintained (Ejiwale, 2013).

5. Conclusion

In conclusion, the study showed that although the principal and the science teachers were aware of the use of contextualization, this strategy was not utilized or adopted. Additionally, they stated that they were unfamiliar with STEM education. This necessitated the development of a localized STEM lesson plan. Moreover, the STEM lesson stages, learning objectives, content, level of contextualization, and overall rating were all described as excellent, and their mean intervals ranged from 3.25 to 4.00. This proved that the STEM lesson on biodiversity that was created had a certain standard of quality as an instrument in this study. Thus, incorporating a localized STEM lesson on biodiversity can aid in developing useful skills such as data gathering and analysis, critical thinking, creativity, and problem-solving to address the problem. It offers a remarkable opportunity to involve students in practical learning activities that stress the real-world applications of science and mathematics. By studying biodiversity, students learn the complex connections between living things and their surroundings and how human activities may affect these relationships. Therefore, employing a lesson within the

context of the prevalent local environment, culture, and resources could aid teachers and students in understanding concepts.

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