

Utilization of Contextualized Learning Material on Non-Mendelian Genetics in Enhancing Student's Achievement

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Abstract

Students grasp concepts more effectively when they witness the practical application and relevance of subjects within their real-life contexts and surroundings. Hence, this study aimed to attain the following objectives: (1) determine the student's achievement scores after utilizing the self-learning material from DepEd (control group) and the developed contextualized learning material (experimental group); (2) determine the significant difference in the achievement scores of the students after utilizing the self-learning material from DepEd (control group) and the developed contextualized learning material (experimental group); and (3) determine the student's perception on the developed contextualized learning material in Non-Mendelian Genetics. This study employed the quasi-experimental method. In particular, the one-group post-test research design to compare the achievement scores of the control group and the experimental group. Furthermore, this study was conducted to the incoming Grade 10 students who participated in the NLC. This involved two (2) existing classes, with the control group comprising of twenty (20) students and the experimental has twenty-one (21), resulting in a total of forty-one (41) participants. Based on the findings, the developed contextualized learning module on non-Mendelian patterns of inheritance significantly helped increase student's performance and addressed the issue in the low mastery of the competency.

Keywords: Non-mendelian genetics, contextualized learning, achievement

1. Introduction

During the school year 2023-2024, the researcher administered a diagnostic test to one hundred twenty (120) Grade 10 students across three (3) classes. The outcomes revealed that the Grade 10 students exhibited the lowest proficiency levels in competencies typically covered during their Grade 9 level. Based on the data, one of the competencies with the lowest score acquired is in Explaining the different patterns of non-Mendelian inheritance (S9LT -Id – 29). The student's reasons for low mastery include a lack of

interest in the topics, poor retention, poor conceptual understanding, and poor prior knowledge about the topic and not thoroughly discussed by the teacher.

In addition, the researcher also conducted a needs assessment interview to the Science teachers to confirm the diagnostic test result. It was also found out that among the Biology topics, Non-Mendelian Genetics emerges as the least mastered area. The primary reason attributed to this challenge is the students' insufficient foundational knowledge pertaining to the topic. As per the teachers' insights, an effective intervention to tackle this issue involves developing instructional materials that specifically contextualize this lesson.

Students who study science frequently struggle with their poor grasp of scientific content, particularly biology. This is supported by a study of Großschedl et al. (2014), which found that helping students advance their knowledge of subjects like biology is the hardest thing for teachers to do. They mentioned that a variety of factors, including the students' motivation, IQ, and prior knowledge, have an impact on these challenges.

Since biology is one of the components of science subjects in the K to 12 curriculums, understanding the difficulties of the learners in this area will provide insights and directions to teachers to better design pedagogical plans. The Department of Education (DepEd) in the Philippines, has been promoting the K-12 program to enhance the delivery of teachings through contextualization and localization. Section 10.2 of the Implementing Rules and Regulations (IRR) of Republic Act (RA) 10533 states that "Curriculum shall be contextualized and be flexible enough to enable and allow schools to localize and enhance the curriculum based on their respective educational and social contexts" (Bhowmik et al., 2013).

To achieve the goal of high-quality education and scientific literacy, contextualization and localization are currently developing theories or techniques. According to Tomlinson and Masahura (2004), the advantages of localizing and contextualizing the curriculum are cultural sensitivity, the potential for personalization, easy availability of resources, direct relevance of materials to learners, and ownership of the development process.

In this study, the researcher developed a contextualized learning material specifically designed to address one of the least mastered competencies in Biology: Non-Mendelian genetics. This study aimed to investigate the effect of the developed material on the student's achievement during the National Learning Camp (NLC).

Specifically, this study aimed to attain the following objectives:

1. Determine the student's achievement scores after utilizing the self-learning material from DepEd (control group) and the developed contextualized learning material (experimental group).
2. Determine the significant difference in the achievement scores of the students after utilizing the self-learning material from DepEd (control group) and the developed contextualized learning material (experimental group).
3. Determine the student's perception on the developed contextualized learning material in Non-Mendelian Genetics.

2. Methods

Research Design

The study utilized a quasi-experimental method particularly the one-group post-test research to assess the impact of the developed contextualized learning material on students' achievement in Non-Mendelian, incorporating both quantitative and qualitative research. A quantitative research was used to present the significant difference of the achievement scores between the control and experimental groups. On the other hand, qualitative research was used to present the results derived from the student's perception on the developed contextualized learning material.

Subjects of the Study

This study involved two (2) existing classes during the NLC, with the control group comprising of twenty-one (21) students and the experimental has twenty (20), resulting in a total of forty-one (41) participants. The overall group mean was computed to ensure the comparability of the control and experimental groups at the start of the experiment.

Instruments Used in the Study

To obtain the validity and reliability of the results of the study, the following research instruments were used:

Posttest Questionnaire.

A 15-item multiple choice posttest questionnaire was used to assess the student's understanding and retention of the material after the intervention. This questionnaire was validated by three (3) Ph.D. professors and experts in Biology and Education from Mindanao State University- Iligan Institute of Technology. An item in the test represents each topic, which includes Incomplete Dominance, Codominance, and Multiple Alleles. Furthermore, to interpret the learners' achievement levels based on their posttest scores, the researcher adapted the interpretation from the K-12 curriculum grading system approved by DepEd. Table 1 below shows the score intervals and their corresponding interpretation used in this study.

Table 1: Interpretation of Student's Level of Achievement

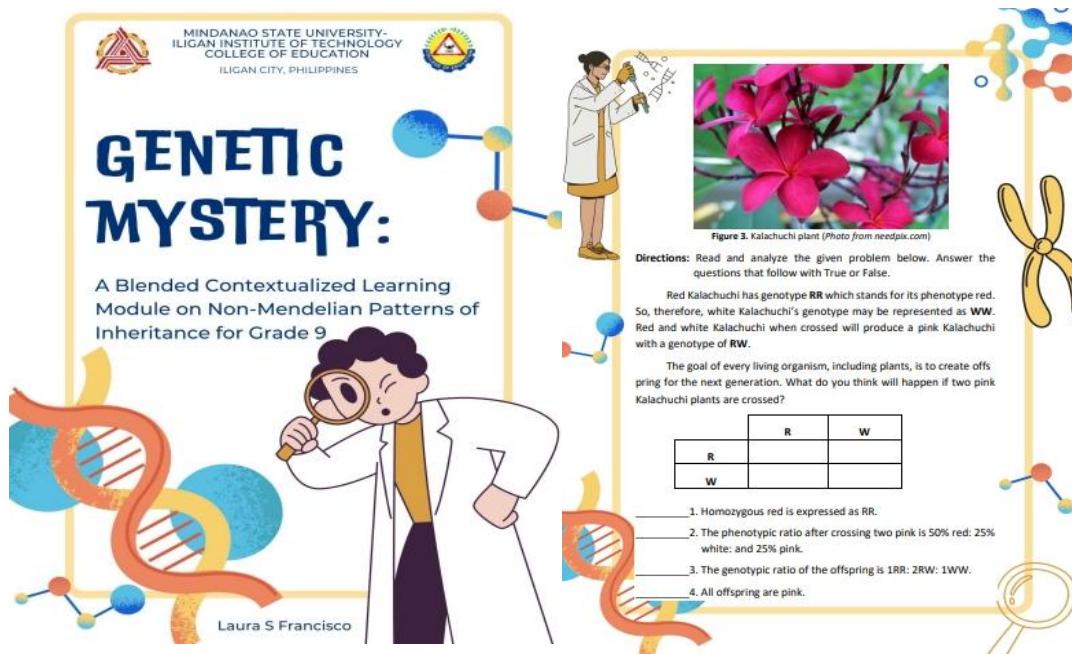
Score Interval	Transmuted Grade	Interpretations
14-15	90%-100%	Advanced
11-13	85%-89%	Proficient
8-10	80-84%	Approaching Proficiency
5-7	75-79%	Developing
0-4	Below 75%	Beginning

Self-Learning Material from DepEd (Control Group)

This study utilized the First Edition (2020) Non-Mendelian Inheritance Material from DepEd for the control group. This was chosen to provide a baseline comparison between the traditional, standardized learning material and the developed contextualized material. By using the established DepEd material, the study aims to evaluate the effectiveness of the new contextualized approach in enhancing student achievement and engagement in comparison to the conventional curriculum.

The contextualized learning material was designed to enable personalized learning paths, allowing students to progress at their own pace. Simultaneously, it offers in-person interactions and activities supported by teachers during the NLC, fostering a diverse learning environment that meets various learning needs. Also, this module is a contextualized material to design a learning environment that is more meaningful, engaging, and applicable, enhancing students' understanding and retention of the material while fostering a deeper connection between the content and their own experiences. In addition, the researcher adapted and modified the seven (7) elements used in developing a learning module from DepEd (2020): Title page, Table of Contents, Pre-test, Introduction, Learning Activities, Assessment/Evaluation, and References.

Developed Contextualized Learning Material (Experimental Group)

**Figure 1.** The Cover Page and Sample Activity of the Contextualized Material*Interviews*

The interview was employed to the experimental group to gather qualitative data on the students' experiences. Also, the interview was conducted informally in group settings to make the students more comfortable in answering the questions. Additionally, the questions explored various aspects of the learning process, including the effectiveness of the material and the students' feedback and perceptions.

Data Collection

Before the data collection, an approval letter was secured and presented to the principal of the target school and asked for their permission to conduct the research study on their students. The same approved letter from the principal was presented to the assigned teacher of the consolidation camp. The developed contextualized material was implemented in two (2) existing classes, with one designated as the control group and the other as the experimental group. The selection of the control and experimental groups was conducted randomly through lottery to ensure fairness and eliminate selection bias. To further ensure comparability between the two groups, students' Science grades were assessed and calculated to determine the overall group mean.

Table 2: Distribution of Students by Group

Group	n	Overall Group Mean (from Grades in Science)	Interpretation
Control	21	80.38	Approaching Proficiency
Experimental	20	81.15	Approaching Proficiency

Table 2 shows the overall group mean ratings of students in Science who are currently enrolled in the consolidation camp. Furthermore, the table shows that both the control and experimental groups is 80.38 and 81.15 respectively, which implies that the groups are not

different in terms of learning the subject. This also implies that the students in this study were appropriate for the consolidation camp because according to Deped Order (DO) No. 14, s. 2023, "Learners who have shown proficiency in the grade-level competencies but may benefit from additional practice and application shall be placed in the Consolidation Camp. The camp shall provide opportunities for learners to reinforce their understanding, make connections between concepts, and further develop their skills across different areas."

Moreover, during the implementation phase, the researcher distributed the self-learning material from DepEd to the control group and the developed contextualized learning material to the experimental group, conducting an orientation session to guide both groups on how to use their respective materials. It was emphasized during the orientation that students had a designated thirty (30) minutes per meeting over a two-week period to complete the module activities. Students were also organized into groups for collaborative tasks, with the researcher providing ongoing assistance to ensure smooth facilitation and address any questions or challenges that arose. This ensured that both groups fully understood the content and were able to engage effectively with the material.

Data Analysis

The researcher employed various statistical tools to analyze the data gathered during the implementation of the contextualized learning module. The mean calculations were utilized to analyze the comparability of the two (2) classes. Furthermore, the researcher employed a Kolmogorov-Smirnov test to test the normality between the two groups and a Mann-Whitney test to determine the significant difference in the post-test results between the two (2) groups.

In the qualitative aspect, the collected data from the interview were then analyzed to determine the effect of the contextualized learning material on the students. This comprehensive approach ensured a thorough evaluation of the new educational resource and its potential benefits for student learning.

3. Results and Discussions

The following discussion presents the analysis of student scores from the posttest on Non-Mendelian Genetics. It also includes a detailed description of the collected quantitative data and insights from student interviews. This comprehensive analysis aims to provide a clear understanding of the students' performance and their perceptions of the learning material.

Achievement Level

Table 3 below presents the results of the posttest of the two groups.

Table 3: Comparison of Raw Scores in the Achievement Test

Raw Score	POSTTEST					
	Control Group			Experimental Group		
	f	%	ITP	f	%	ITP
14-15				7	35	A
11-13	8	38.1	P	10	50	P
8-10	11	52.38	AP	3	15	AP
5-7	2	9.52	D			
0-4						
Total (Mean)	21	100	AP	20	100	P

Legend: ITP – Interpretation: A- Advanced: P- Proficient;

AP- Approaching Proficiency; D-Developing; B- Beginning

In the control group, the majority of students (52.38%) scored between 8-10, indicating they are approaching proficiency, while 38.1% of students scored between 11-13, indicating proficiency. A small portion (9.52%) scored between 5-7, indicating developing proficiency. The mean performance level of the control group is "Approaching Proficiency (AP)". In contrast, the experimental group had the largest portion of students (50%) scoring between 11-13, indicating proficiency. Additionally, 35% of students scored in the highest range (14-15), indicating advanced proficiency, and 15% of students scored between 8-10, indicating approaching proficiency. There were no students in the developing (5-7) or lowest (0-4) ranges. The mean performance level of the experimental group is "Proficient (P)".

These implies that the experimental group performed better overall compared to the control group. The experimental group had a higher percentage of students scoring in the proficient and advanced categories, with no students in the developing or lowest categories. The mean performance of the experimental group was proficient, while the control group's mean performance was approaching proficiency. This suggests that the intervention or treatment applied to the experimental group was effective in improving their posttest scores.

Interpretation and Comparison of Achievement Level (Posttest)

The posttest served as a critical tool for evaluating the students' performance following their exposure to the learning materials in both the control and experimental groups.

Table 4: Interpretation of Student's Level of Achievement

	Control Group	Experimental Group
Overall Mean	10.04	12.65
Transmuted Grade	80%-84%	85%-89%
Interpretations	Approaching Proficiency	Proficient

The table 4 shows the interpretations of scores of the control and experimental groups. The control group has a mean score of 10.04 which falls to a transmuted grade of 80-84% and interpreted as "Approaching Proficiency". While the experimental group has a mean score of 12.65 which falls to a transmuted grade of 85-89% and interpreted as "Proficient".

Moreover, this study claimed that there is difference on the mean scores of posttests between the control group who used the self-learning material from DepEd and the developed contextualized learning material on Non-Mendelian Genetics. On the role of localized and contextualized science activities in improving students' academic performance, learners who get localized and contextualized instruction outperform their peers academically (Ballesteros, 2019).

Comparison of the Achievement Level of Two Groups

Before comparing the significant difference of the achievement level of two groups, the researcher run a test of normality using the Kolmogorov-Smirnov test. Based from the findings of the result, the p-value for the scores under experimental group is .008 which means that the distribution of the score under this group is not normal. Therefore, the use of Mann-Whitney test is appropriate.

Table 5 below presents the results on the test of significant difference of the posttest scores in the control and experimental groups after exposing to the materials.

Table 5: Difference of the Scores in the Achievement Test

Group and Test Compared		N	Std. Dev.	Test Used	Mann-Whitney U	p-value	Decision
Between Groups	Posttest (Control)	21	1.66	Mann-Whitney Test	63.000	.0001	Significant
	Posttest (Experimental)	20	1.74				

Table 5 displays the Mann Whitney test results between two group's posttest scores during the implementation of the materials. According to the results, there is a significant difference on the student scores in the achievement test between the control group and the experimental group. Particularly, the experimental group's post-test results were significantly higher than the control group. Further analysis reveals that, following the utilization of the contextualized learning module, students had a better grasp of the concepts related to Non-Mendelian genetics. The benefit of having a contextualized learning module is that it presents fresh perspectives, methods, and learning chances that improve students' knowledge and assist them in overcoming knowledge gaps and difficulties (Setyani et al., 2020).

Field Notes

The following are the insights from the interview in terms of their learner's perception towards the developed contextualized learning material.

"The contextualized learning module is very beneficial because it connects the material to real-life examples we can relate to, making it easier to understand and remember," one student commented. Another added, *"Using local examples helps me see how genetics applies to my own community, which is really motivating."* Students appreciated the integration of local context, noting that *"it makes learning more relatable"* and *"I feel more connected to the material because it reflects my own experiences."* One student observed, *"The examples in the module are things I see in my daily life, so I can relate to them better and understand the lesson more clearly."*

However, some students mentioned challenges with the contextualized approach. One student noted, *"Some examples are too specific to one area"* Others pointed out, *"There are words that I still can't understand because it is deep."*

In terms of collaboration, students had mixed feelings. *"Discussing in groups helps us understand different perspectives and learn from each other,"* one student said. However, some students felt that *"in group work, there are some classmates that do not participated."*

The student's perception during the interview disclosed that they agreed that they were successful in achieving the learning objectives. Students appreciated the relevance and engagement provided by the material but also emphasized the need for careful implementation in terms of the group activities and further enhancement on the content of the contextualized learning material. According to Navalta (2021), contextualization in the teaching-and-learning process are effective as it engages and improve students' conceptual understanding and show significant learning experiences when being used. Thus, creating a positive impact on the learning process.

4. Conclusions

Based on the findings, the developed contextualized learning material on Non-Mendelian patterns of inheritance significantly helped increase student's performance and addressed the issue in the low mastery of the competency, demonstrating its efficacy in enhancing students' understanding and mastery of the subject matter.

Specifically, the control group has a mean score of 10.04 which falls to a transmuted grade of 80-84% and interpreted as “Approaching Proficiency”. While the experimental group has a mean score of 12.65 which falls to a transmuted grade of 85-89% and interpreted as “Proficient”. In addition, as evidenced by the Mann Whitney test, there is a significant difference on the student scores in the achievement test between the control group and the experimental group. Particularly, the experimental group’s post-test results were significantly higher than the control group. Further analysis reveals that, following the utilization of the contextualized learning module, students had a better grasp of the concepts related to Non-Mendelian genetics.

Furthermore, qualitative data drawn from student’s interview disclosed that they agreed that they were successful in achieving the learning objectives. Students appreciated the relevance and engagement provided by the material but also emphasized the need for careful implementation in terms of the group activities and further enhancement on the content of the contextualized learning material.

To enhance student’s achievement in learning non-Mendelian inheritance patterns, it is recommended to implement the developed material concentrating in both public and private educational institutions. This implementation seeks to enhance students’ understanding and memory retention, aiming for a connection between the subject matter and their individual experiences.

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