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Designing Localized Learning Exemplar in Teaching Mendelian Genetics Using 4A's Model for Grade 8

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Abstract
Aim: This study aimed to design a Localized Learning Exemplar (LLEX) using the 4As model that aids the teaching-learning process of Science 8 students, especially the frequent least-mastered competency lessons in Mendelian genetics.
Methodology: The designed LLEX was evaluated by two sets of experts (three content and three usability experts) where they evaluated LLEX as 'high' in use and 'good' in the content. There were 15 selected teacher-respondents from selected schools in Butuan City Division to answer the survey questionnaire and 45 grade 8 student-respondents of Ampayon National High School. Developmental and one-group pretest/ post-test quasi-experimental design was used in this study.
Results: The foregoing results suggest that the improvement in the post-test was attributed to the knowledge gained of the students from completing the worksheets/ activities as part of instruction. Results show that LLEX can be used as grade 8 science teacher supplementary material in teaching, but it needs improvements to master all the competencies in the content.
Conclusion: This LLEX using the 4As model is very helpful, especially to students that need remediation and teachers who have a misconception about localized instructional materials.

Keywords: Localized Learning Exemplar (LLEX), 4As model, Designing Teaching Mendelian Genetic

INTRODUCTION

In the country, the Department of Education issued an order to implement a new curriculum, the K to 12 Basic Education Curriculum, for all schools nationwide last S.Y. 2012-2013 (K to 12 BEC). In this curriculum, the students use ready-made learning materials (L.M.) that are catered on a day-to-day basis following the K to 12 Science Curriculum Guide. This new curriculum is seen as one of the answers to improve the quality of education in the country. The K to 12 Curriculum highlights some key features which are geared toward addressing students' differences and learning styles. For this new curriculum, contextualization and localization of instruction are its new features. But the ready-made learning materials that students are using seemed to be inappropriate for some reason. Few of these reasons include, students are unable to perform all the activities in the L.M., especially its time-consuming activities and need constant supervision coming from the field teachers and learning materials design are not applicable to all students because there are materials that are not available in the local schools especially the laboratory apparatuses in Science (Perez, 2017).

In the delivery of instructions, instructional materials act as a conduit between the teacher and the students. The motivation on the teaching-learning process while it serves as the motivation on teaching-learning process while serves as the motivation (Adalikwu & Iorkpilgh, 2013). With this premise, the concept of contextualization and localization, which is also labeled in many studies as contextualizing teaching and learning (CTL), truly aligns with the thrusts and mandates of the Department of Education. According to Bete (2018), localization is about making content usable and adaptable to meet local needs, addresses teaching or learning style, adapt to different grade levels, disciplines, learning environment, needs, cultural preference, school, or district's standardized curriculum and to support a specific pedagogical need.

Developing countries face greater challenges in science education than economically developed countries due to the lack of teaching materials, including books, computers, and communication technologies, community-based science centers, laboratory facilities, and equipment, as well as the shortage of skilled teachers (Ballesteros, 2015). Teachers have a critical role in ensuring that tools are used efficiently to support the students, by using authentic or localized instructional materials and texts in teaching the below-average students to become participative and inclined to use their higher level of thinking skills.

Nowadays, teachers are challenged to make localized and contextualized instructional materials that can enhance the students' interest and learning performance. The purpose of instructional materials is to promote the efficiency of education by improving the quality of the teaching and learning process. Incorporating these tools and materials presents and reinforces teaching.

Based on the K-12 program, teachers should embrace a different style as they perform the teaching-learning process throughout the respective class activity. Some learning competencies in genetics are not fully grasped by the students. Students' difficulties in learning genetics have been studied by various researchers. Teaching genetics is interesting yet challenging for students to understand. Discussions, using textbooks, problem-solving activities are some of the common teaching strategies most teachers use in this topic (Lodge et al., 2018)

This study was supported by different theories that emphasized the importance of using contextualized materials for the effectiveness and efficiency of the teaching-learning process. Motivation theory encourages the students to reflect on their ideas. Thinking about the content with the real-world experience is important because once the student can see the real-world relevance of what they are learning, they become interested and motivated. Social learning theory is an explanation of how students learn when they are in a social context. Students are encouraged to create and understand their learning within social situations associated (Fernandez et al., 2019).

This study was anchored on the ADDIE model as shown in Figure 1, the Analysis Phase, Design Phase, Development Phase, Implementation, and Evaluation phase in developing the instructional materials on genetics.

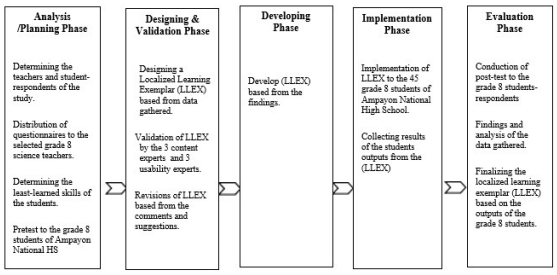

Figure 1. The ADDIE model in Designing Localized Learning Exemplar (LLEX) on Mendelian Genetics

Objective

The main purpose of the study was to design a localized learning exemplar (LLEX) for teaching Mendelian genetics using the 4As model in Grade 8.

This study sought to answer the following questions:

1. What are the learning objectives in Mendelian genetics that are applied with localized instructional materials in grade- 8 science teachers?
2. How do grade-8 science teachers implement localized instructional materials in the 4As model of teaching Mendelian genetics?
3. How do grade 8 students achieve the learning objectives of Mendelian genetics?
4. What localized learning exemplars may be developed in teaching Mendelian genetics under the 4As model?
5. Does the use of Localized Learning Exemplar among grade-8 teachers in teaching Mendelian genetics utilizing 4As affects the students' achievement of learning objectives?
6. What is the quality of the designed Localized Learning Exemplar based on the following criteria: a. Validity and b. Usability?

METHODS

The researchers identified the least mastered competency of Grade 8 science students and found out that mastery level was not achieved in the previous school years. Thus, the researchers chose the least mastered competency in all the competencies given by the Department of Education as a basis in designing instructional materials. A pretest was given to the grade 8 students of section Jade participants before the series of activities, and a post-test was given afterward.

Research Design

This research study used the developmental and one-group pretest/ post-test quasi-experimental design. It aimed to design and develop Localized Learning Exemplar (LLEX) using the 4As model in teaching Mendelian Genetics. It also aimed to measure the effectiveness and validity of the instructional materials.

Research Participants

The participants of the study were the 45 grade 8-Jade students of Ampayon National High School and 15 grade 8 science teachers in selected schools of Butuan City Division. There were three content experts in a particular field and three usability experts. The three content experts were from the biology department of Caraga State University, Ampayon, Butuan City, and three usability experts from the Department of Education Butuan City Division at least ten years in teaching Science.

Research Locale

The study was conducted at Ampayon National High School. It is a public secondary school located at barangay Ampayon, Butuan City. Ampayon is a barangay in the city of Butuan. The named Ampayon was named from the root crop product known as "camote" which was planted by the early Christian Settlers. The camote crop was later called "Ampay Hong Butuan" or "Ampay yaon Hong Butuanon" which means the favorite of the Butuanons. Since the barrio

was producing this crop, so as the years passed, the barrio was named Ampayon.

Research Instrument

The researcher used the instruments in gathering the data. There was 15 validated teachers' questionnaire, 1 validated Localized Learning Exemplar (LLEX) with a rating of good content and highly usable in designing and development, three validation forms of the content experts, and three validation forms of the usability experts adapted from Salviejo, E. et al. (2014) with modifications as to the effectiveness and relevance of the localized learning exemplar and 45 Pretest-post-test questionnaires in determining the gain scores of the students to its level of achievements.

Data Gathering Procedure

The questionnaire was administered to the 15 grade 8 science teachers in selected schools of the Butuan City Division. Based on the data gathered, the researcher designed instructional materials applying the 4As (Activity, Analysis, Abstraction, and Application) strategy of teaching. For the validity of the developed instructional materials, the researcher looks for three content experts and three usability experts to evaluate and validate the instructional materials. The content validation was done at the Biology Department in CSU, and three (3) usability experts from the Department of Education, Butuan City, helped the researcher in revising the draft. In determining the worksheets, the researcher ensures the activities were conceptualized and localized, written effectively, appropriately, and suitable to the learnings of grade 8 students. Pretest and post-test were recorded before and after using the LLEX.

Scoring and Quantification of Data

The following scales were used to quantify the data of the study:

1. Content Validity of Localized Instructional Material (Validators)

Scale	Descriptive Rating
5	Very Good
4	Good
3	Fair
2	Poor
1	Very poor

2. Content Usability of Localized Instructional Material (Validators)

Scale	Descriptive Rating
5	Very high
4	High
3	Moderate
2	Low
1	Very low

Statistical Treatment of Data

The data gathered were compiled, sorted out, organized, tabulated, and subjected to statistical treatment to facilitate the presentation, analysis, and interpretation. The following statistical tools/test were utilized:

1. Gain scores from pretest and post-test results were used to determine the level of achievement of the students on the localized learning exemplar.
2. Weighted mean from the result of the expert's validation was used to determine the content usability and validity of the localized learning exemplar.

RESULTS and DISCUSSION

Learning objectives in mendelian genetics that are applied with localized instructional materials in grade- 8 science teachers

The percent distribution of teacher participants as to learning objectives in the topic Mendelian genetics with localized instructional materials is shown in Table 1. It is noteworthy that the majority of the teachers thought to have localized instructional materials in the three (3) topmost learning objectives under the topic Mendel's Discovery of the Principles of Heredity; namely, give the traits and characteristics of a pea plant used by Gregor Mendel (86.7%), draw the seven traits and characteristics of a pea plant used by Gregor Mendel (73.3%), and define the following terms: true-breeding, hybridization, monohybrid cross, dihybrid cross, P generation, F1 and F2 generation (86.7%). These topmost learning objectives chosen by the respondent teachers in delivering the content were very accessible and readily available in genetics books, on the internet, and other references. On the other hand, the two (2) of the learning objectives under this content standard are wanting for localized instructional materials such as to give reasons why Gregor Mendel used pea plants in his experiments (20.0%) show and give some allelic pairs from the pictures given (26.7%). In this case, some of the teachers did not localize the lesson; instead, they relied only on the provided k-12 learning module. Banet (2000) traditional strategies for teaching genetics rely on teacher explanation, textbooks, and problem-solving activities in which problems are solved by the application of an already known algorithm.

In the content under Law of Segregation, the three (3) topmost learning objectives of the teachers using localized instructional materials were the following: Use of punnett square to predict the results of a monohybrid cross stating the genotypic and phenotypic ratio (100%), discussing Mendel's Law of segregation (73.3%) and distinguishing terminologies such as dominant and recessive, heterozygous and homozygous, genotype and phenotype (66.7%).

In the content under Law of Independent Assortment, the three (3) topmost learning objectives

of the teachers using localized instructional materials were the following: Determine and give the genotype and the phenotype expressions of the offspring with (93.30%), use a punnett square to predict the results of a dihybrid cross stating the genotypic and phenotypic ratio of the F2 generation (73.30%) and state Mendel's Law of Independent Assortment and describe how this Law can be explained by the behavior of chromosomes during meiosis with (53.30%). On the other hand, discussing Mendel's Law of Independent Assortment (40.00%) was the least of using localized instructional materials.

Table 1. Percent distribution of teacher participants as to learning objectives in the Mendelian genetics with localized instructional materials.

Contents with Learning Objectives	Percent (%)
Mendel's Discovery of the Principles of Heredity	
• Give the traits and characteristics of pea plant used by Gregor Mendel	86.7
• Draw the 7 traits and characteristics of pea plant used by Gregor Mendel.	73.3
• Define the following terms:true breeding, hybridization, monohybrid cross, P generation, F1 and F2 generation.	86.7
• Give reasons why Gregor Mendel used Pea plants in his experiments	20.0
• Show and give some the allelic pairs from the pictures given.	26.7
Law of Segregation	
• Describe Mendel's Law of segregation and the phase of meiosis in which it is applied.	33.3
• Use a punnett square to predict the results of a monohybrid cross stating the genotypic and phenotypic ratio.	100.0
• Distuinguish between the following pairs of terms: dominant and recessive, heterozygous and homozygous, genotype and phenotype.	66.7
• Determine and give the genotype and the phenotype expressions of the offsprings	20.0
• Discuss Mendel's Law of segregation	73.3
Law of Independent Assortment	
• State Mendel's Law of Independent Assortment and describe how this Law can be explained by the behavior of chromosomes during meiosis.	53.3
• Use a punnett square to predict the results of a dihybrid cross stating the genotypic and phenotypic ratio of the F2 generation.	73.3
• Determine and give the genotype and the phenotype expressions of the offsprings.	93.3
• Discuss Mendel's Law of Independent Assortment.	40.0

Most Teachers indicated that they were teaching according to the ideals of the new curriculum, but research showed that they tend to teach the way they tend to teach. One of the difficulties that educators confront is that they are frequently forced to learn new ways of teaching that are significantly different from what they were taught as students. (Schell and Butler, 2018).

As presented in table 1, some of the respondent science teachers did not localize the learning objectives. Instead, they rely only on the provided k-12 learning module. Traditional strategies for teaching genetics rely on teacher explanation, textbooks, and problem-solving activities in which problems are solved by the application of an already known algorithm. Many educators who are experimenting with new ways must do so with little or no guidance from more experienced teachers on how to make them work (Schell and Butler, 2018).

Implementation of localized instructional materials in the 4As model of teaching mendelian genetics in grade-8 science teachers

Figure 2a shows the percent distribution of teachers as to the localized materials used in teaching Mendelian genetics. As presented in the figure, the majority of the teachers used at least two (2) books for the localized materials in the 4As model of teaching Mendelian genetics (40.0% for at least three books and 46.7% for two books). These books are the K-12 science module (100.0%) and old reference books (60.0%) (Figure 2b). Perceptions of the teachers using the provided learning modules in the Department of Education were considered localized. Some books provided were not localized and needed to be localized in a certain community/school. There is a need for new instructional materials for Mother Tongue-Based-Multilingual Education instructions that are supported by the Department of Education (DepEd). In relation to this, other authors reasoned out that when instructional resources are developed and evaluated by individuals related to the context of the community intended, these resources are easier to adapt and localize by the end-users (Jimes, 2011; Lear, 2020).

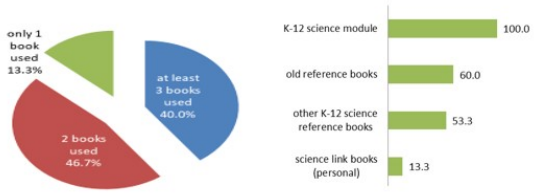

Figure 2a. Percent distribution of teachers as to books used in teaching Mendelian genetics.

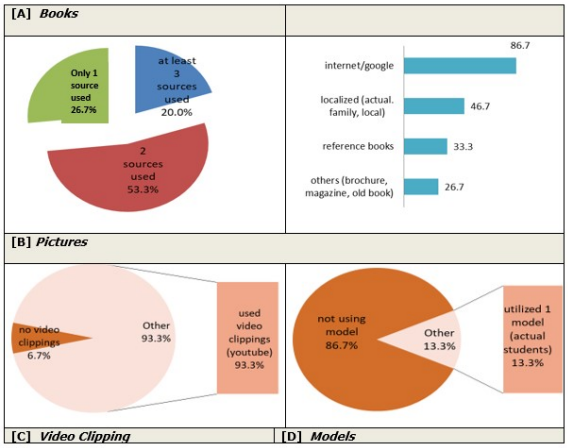

Figure 2b. Percent distribution of teachers as to the localized materials used in teaching Mendelian genetics.

Using of pictures, only a few (20.0%) with at least three sources of pictures for localized instructional materials. But the majority have at least two sources primarily coming from the internet/ google (86.7%) and from localized sources such as actual pictures, family pictures, or local pictures (46.7%). The majority of the teachers use pictures coming from internet sources and less in localized pictures. Mostly, the pictures that came from the internet were foreign pictures. In this case, the teachers did not meet the local needs and the local race of the students. According to Taylor (2014), localization is the freedom for schools to adopt the curriculum to local conditions.

For the video clipping, the majority (93.3%) have access to YouTube. Video clippings coming from internet sources are effective in teaching compared to the traditional way of teaching. Empirical studies have generally confirmed that online instructional videos present information in a more attractive and effective manner than traditional face-to-face lectures and thus achieve higher engagement levels and learning capabilities among students (Al-Jarf, 2012).

The majority of the teachers (86.7%) did not employ models in teaching Mendelian genetics. About 13.3% claimed to have employed actual students as models in teaching. Teachers play an important part in the creation of learning materials that are appropriate for the needs of the students. Teachers should have other learning resources in addition to textbooks, according to the United Nations Educational, Scientific, and Cultural Organization (UNESCO). The training program for educators should be included in the construction of curriculum, specifically materials innovations (Mouraz & Leite, 2013).

The results show that teachers are dependent on using books from the DepEd module, pictures from the internet, and video clippings on YouTube. This is in contrast with Ballesteros (2016), who argued that a science teacher should be familiar with the immediate school environment and the community to be able to source out all the human and non-human materials that can facilitate science learning.

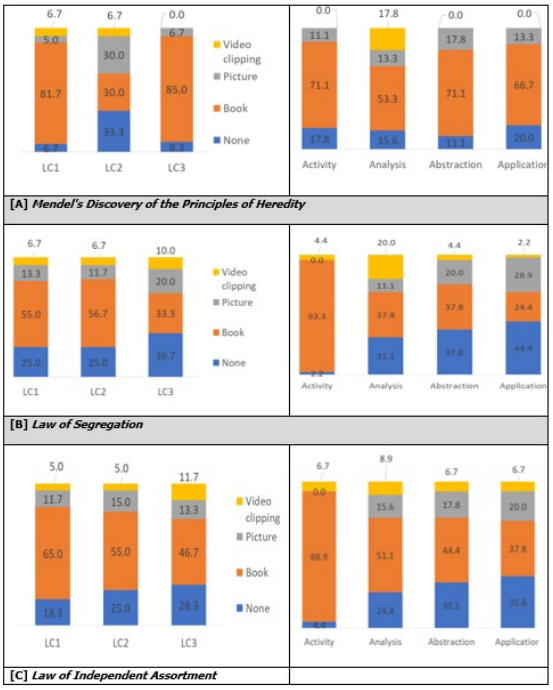

Figure 3. Percent distribution of localized materials used in teaching Mendelian genetics under 4As (Activity, Analysis, Abstraction, Application).

As can be gleaned from figure 3 showing the percent distribution of localized materials in teaching Mendelian genetics under 4As, in the content Mendel's discovery of the principles of heredity, the majority of the teachers claimed to have used localized instructional materials in books for LO1 and LO2, 81.7% and 85.0%, respectively. These same books were used as sources for the materials in developing learning experiences for activity, analysis, abstraction, and application. Reference books in delivering the lesson are not an example of a true localization. Rather, it is a misconception. While it is critical to guarantee that each learner has access to the right amount of learning materials, it is also critical to ensure that the teachers are using high-quality learning resources. Teachers, according to (Zulyadaini, 2017), should pay more attention to the relevance of educational materials to students' life. Curriculum development should prioritize learning materials that will transform learners into community builders (Huang and Chang, 2018).

For Law of segregation, most of the teachers claimed to have used localized instructional materials in books for LO1 and LO2, 55.5% and 56.7%. In the activity part, almost reach 100.0% of teachers used books. Meanwhile, for the content Law of Independent Assortment, there were 65.0% in the LO1, 55.0% in the LO2, and 46.7% in the LO3 used

books as localized instructional materials. Only a few used pictures in teaching the content. It shows that some teachers had a misconception of the word localization. According to Bete (2018), localization is about making content usable and adaptable to meet local needs, it addresses a particular teaching style or learning style, to adapt in different grade levels, disciplines, learning environment, needs, cultural preference, school or a district's standardized curriculum and to support a specific pedagogical need.

Achieving the learning objectives of mendelian genetics in grade 8 students

The topmost least mastered competencies of the students were the following: Provide the phenotype and genotype of the given alleles and show the possible offspring using a punnet square by crossing the given dihybrid traits with 46.7%. The topmost mastered competencies got 33.3%, only the competencies that determine pure dominant and recessive alleles and give the traits and characteristics of the pea plant used by Gregor Mendel (Table 2).

Table 2. Percent distribution of teacher-participants as to identified Grade 8 students' least mastered and mastered competencies in the learning objectives of Mendelian genetics.

A. Least Mastered Competencies	
Provide the phenotype and genotype of the given alleles.	46.7
Show the possible offspring using a punnet square by crossing the given dihybrid traits	46.7
Give the genotype and phenotype expressions of the offsprings	26.7
Give the genotype, phenotype and its ratios of the possible offspring.	20.0
Compare the no. of chromosomes of the daughter cells resulting from mitosis & meiosis	13.3
Describe and compares the processes of mitosis and meiosis	13.3
Determine pure dominant and recessive alleles	13.3
Explains the significance of meiosis in chromosome	13.3
Describe the role of cell cycle	6.7
Determine gametes of the father and mother using the Law of segregation	6.7
identifies phenotypes as the expression of inherited characteristics	6.7
B. Mastered Competencies	
Determine pure dominant and recessive allelles	33.3
Give the traits and characteristics of pea plant used by Gregor Mendel	33.3
Give reasons why Gregor Mendel used pea plant in his experiment	20.0
Describe how the union of egg & sperm results to variation	13.3
Differentiate heterozygous from homozygous	6.7
Differentiate oogenesis and spermatogenesis	6.7
identify the organelle that involved in cell division	6.7
Explain the significance of meiosis	6.7

It showed that the students did not master all the competencies, and the researcher found out that because of the inappropriate instructional materials used by the teachers. There was a positive correlation between the teacher's content knowledge and learners' achievement, and that inadequate teacher training, in turn, resulted in teachers relying heavily on textbooks (Muwanga-Zaka, 2004). In the literature review of Osborne et al. (2003) on the attitudes of students in Science, they have argued that although there are many factors associated with the decline of students' achievements in Science, one striking factor is the quality of teaching. They have insisted that science teaching has to be engaging to the students and provide a classroom environment and activities that raise students' interest in Science. Beswick (2014) stated that teachers need to know not only the content they teach but also much more.

The Localized Learning Exemplars (LLEX) using the 4As model focused on the student-centered activity intended for science 8 with competency-based worksheets. This is highly recommended for remedial classes; hence the students can answer and learn from this module with less supervision from the teacher. This LLEX used localized instructional materials wherein students were the direct sample, and mostly the pictures found were within the classroom setting. Each worksheet has desired outcomes based on the learning competencies in the K to 12 curriculum guides in Science for the content Mendelian Genetics. Contextualization and Localization of Outcomes-Based Instructional Materials (CLOBIMS) were used in localized learning exemplars (Sharma, 2014).

There were three lessons covered in this module, namely, Gregor Mendel and the Science of Genetics as an introductory part, Law of Segregation - monohybrid cross, and Law of Independent Assortment- Dihybrid cross. The learner demonstrates an understanding of Mendelian Genetics by answering each worksheet following the 4As model (Activity, Analysis, Abstraction, and Application) with time allocation to worksheet provided and through contextualization and localization of activities to assist the learners to achieve the content standard. Cognitive, affective, psychomotor, collaborative, and cooperative learning of the students involves answering the 14 worksheets in this module.

Use of Localized Learning Exemplar among grade-8 teachers in teaching Mendelian genetics utilizing 4As affects the students' achievement of learning objectives

Figure 4 shows the analysis of the grade 8 student's achievements with Localized Learning Exemplars utilizing 4As. The post-test score and gain score are highly correlated (p-value < 1%) with the

achievement of the students in the previous period in terms of the mean percent score (MPS). This correlation is not significant between the pretest score and MPS. These results imply that the achievement level of the grade 8 students was because of the employment of the Localized Learning Exemplar using 4As. As pretest scores show some random effect on the student's achievement of the Mendelian genetics (p-value greater than 5%), the post-test scores provide evidence of appropriate learning with an average increase of 42.3%.

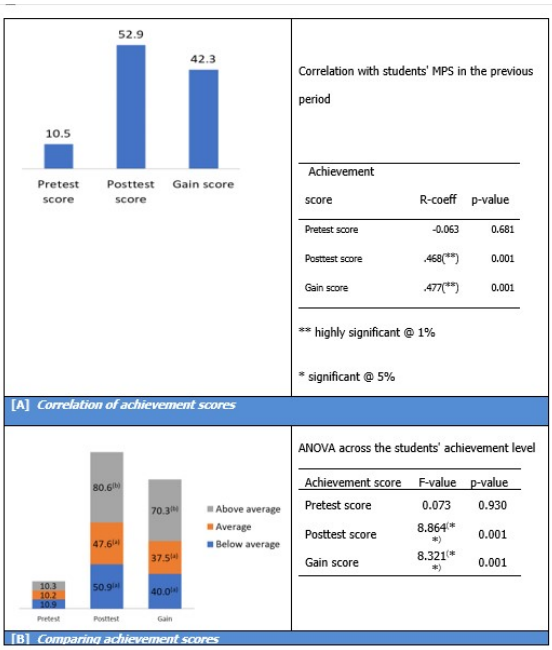

Figure 4. Achievement level (in mean percent score) of the students in Mendelian genetics with the localized learning exemplar under 4As

Moreover, analysis with the previous students' previous achievement in the science learning competencies shows a significant increase in the achievement of students classified as below average. With the LLEX under 4As, below average has enhanced achievement with post-test score and gain score higher than the average level (though not significant at 5% for a pairwise test).

The foregoing results suggest that the improvement in the post-test was attributed to the knowledge the students gained from completing the worksheets/ activities as part of instruction. Not only did the science students learn the science lesson in genetics, but they enjoyed the activities as well. The activities involved active experiences and working in groups, all of which students enjoy. According to Bulusan (2019), genuine learning materials are those that have high relevance and a clear connection to the learners' motivations, needs, and histories. (too old reference)

Above-average students were able to maintain their achievement level with a mean percent post-test score of 80.6% and a mean percent gain a score of 70.3% findings of this study confirm that instructional materials enhance students' achievement (Togonon, 2011). It should be prioritized to have a training program that focuses on the teacher as the creator of the curriculum. Teachers are at the heart of any curriculum creation effort because of their expertise, experience, and skills. Learning outcomes for students will improve if teachers have a greater say in the curriculum's development (Patankar and Jadhav 2013).

Validity of the Instructional Materials in terms of Content

The three content experts validated the localized learning exemplar for Mendelian genetics under 4As in terms of; Objectives, Content, and Instructional Design. Table 3 shows the summary of the ratings of the content validity of the localized learning exemplar for Mendelian genetics under 4As. As presented in Table 3, the highest mean rating of the content experts was 4.33%, interpreted as Good. The criteria got this rate was the following: the activities and the concepts are relevant to the objectives, assess prior knowledge of the students, assess learner's attainment on the learning objectives, and help learners apply their learning to a new situation and apply it to their own lives. All these were interpreted as good.

The grand mean is 3.92%, and it implies that there was a good alignment of the LLEX to the k-12 grade 8 science curriculum as to objectives, content, and instructional design. However, it also presents a poor rating in providing students opportunities to work with more guided practice because the LLEX contains a series of 4 answer sheets only in activity, analysis, abstraction, and application with time allocation to each sheet. This can be noted that the materials need to be improved for the students to master the competencies. According to the citations of Ituma (2015), learning involves collaboration between instructors, students, and resources. Teachers, according to Sharma (2014), facilitate learners' past experiences and connect them to new knowledge by utilizing regional knowledge, culture, and materials.

Table 3. Summary of the ratings of the content validity of the localized learning exemplar for Mendelian genetics under 4As.

CRITERIA	MEAN	DESCRIPTION
A. LESSON OBJECTIVES		
1. The objectives are based on the prescribed in the k-12	3.67	Good
2. The learning objectives are specific, measurable, realistic & time bounded.	4.00	Very Good
B. CONTENT		
1. The contextualized outcomes-based instructional materials serves as a model in explaining the ideas and principles of the competencies prescribed in the K-12 Science curriculum.	3.67	Good
2. The concepts introduced in the activities are relevant.	4.33	Good
3. The activities are appropriate to the level of the grade 8 students.	3.67	Good
4. The contextualized outcomes-based instructional materials provides skills for better mastery of the least developed competencies.	3.67	Good
5. The activities are relevant to the objectives.	4.33	Good
C. INSTRUCTIONAL DESIGN		
1. The contextualized outcomes-based instructional materials provides activities that will assess prior knowledge of the students.	4.33	Good
2. The contextualized outcomes-based instructional materials provides activities to enable learners to work on the new lesson.	4.00	Good
3. The contextualized outcomes-based instructional materials to help students to develop positive attitude on the objectives.	4.33	Good
4. The contextualized outcomes-based instructional materials provides students opportunities to work for more guided practice.	2.33	Poor
5. The contextualized outcomes-based instructional materials provides activities to assess learners' attainment on the learning objectives.	4.33	Good
6. The contextualized outcomes-based instructional materials provides activities to help learners apply their learning to a new situation and apply it to their own lives.	4.33	Good
Grand Mean	**3.92**	**Good**

Description: 1.00 – 1.49 very poor, 1.50 – 2:49 poor; 2.50 – 3:49 fair; 3.50 – 4:49 good; 4:50 – 5:00 very good

Validity of the Instructional Materials in terms of Usability

The three usability experts validated the Localized Learning Exemplar for Mendelian genetics under 4As in terms of readability, user-friendliness, and adaptability. Table 4. Summary of the ratings of the Usability of the localized learning exemplar for Mendelian genetics under 4As.

As presented in table 4, the highest mean rating of the usability experts was 4.33% and interpreted as high. The items got this rating was the text font is clear, the presentation of the material is attractive and appropriate, the teacher wants to use instructional materials in a regular classroom teaching, inspires, and encourages students to learn more topics in biology, and the material fits the needs of the students. However, there were items that got a rate of moderate with 3.33%. The general layout of the material contributes to the motivation of the students, the instruction of each activity was clear and readable, and explanations provided in the instructional materials were understandable. It can be noted that the materials need correction for more improvement.

Table 4. Summary of the ratings of the Usability of the localized learning exemplar for Mendelian genetics under 4As.

CRITERIA FOR EVALUATION	Mean	Description
A. READABILITY		
1. The text font is clear.	4.33	High
2. The presentation of the material is attractive and appropriate.	4.33	High
3. The general layout of the material contributes to my motivation	3.33	Moderate
4. The instruction of each activity is clear and readable.	3.33	Moderate
5. The language structure fits to my learning needs.	3.67	High
B. USER-FRIENDLINESS		
1. The material can be used with less supervision from the teacher.	3.67	High
2. The presentation of the concepts in the material is clear and fitted to students' needs.	4.00	High
3. The organization of each lesson is easy to follow.	4.00	High
4. I could easily understand the explanations provided in the instructional materials.	3.33	Moderate
5. I want to use the instructional materials in a regular classroom teaching.	4.33	High
6.The instructional materials inspires and encourages students to learn more topics in biology.	4.33	Very High
7. The instructional materials uses words and terms suited to students reading comprehensions.	4.00	High
C. ADAPTABILITY		
1. The material is flexible to the size of the student learning group.	4.00	High
2. The activities of the materials fits my needs.	4.33	High
3. The activities fits the different learning skills of the students.	4.00	High
4. The material can be used with different learning groups.	4.00	High
Grand Mean	**3.94**	**High**

Description: 1.00 – 1.49 very low, 1.50 – 2:49 low; 2.50 – 3:49 moderate; 3.50 – 4:49 high; 4:50 – 5:00 very high

The grand mean presented in table 4 was 3.94%, interpreted as high, and shows that LLEX usability can be used as grade 8 science teacher supplementary material, but it needs more improvements to master all the competencies in the content. According to Bete (2018), localization is about making content usable and adaptable to meet and support local and pedagogical needs.

Conclusion

The localized instructional materials are not applied in the learning objectives listed by the teacher-respondents, and also, Science teachers did not implement localized instructional materials in teaching. There is a prevailing misconception among science teachers on using books, pictures from the internet, and video clippings in Youtube as localized instructional materials in teaching Mendelian genetics. The grade 8 science students have very high achievements in the content Mendelian Genetics after using the LLEX. The developed LLEX using the 4As model covering three lessons with time allocation to each worksheet in Mendelian Genetics was suitable, especially since this lesson was the last topic in the fourth quarter. In addition, the use of LLEX effectively enhances the performance of students in Science. Experts rate the LLEX as a promising material for teaching Science. There is a good alignment of the LLEX to the k-12 grade 8 science curricula as to objectives, content, and instructional design. Furthermore, experts rate the LLEX to be of high Usability as support material, but it needs some improvements to master all the competencies in the content.

It could be a good practice for teachers to apply the localized instructional materials in the learning objectives of Mendelian genetics. To ensure the teachers do not have misconceptions about the use of localized instructional materials, they should be exposed by attending seminars on the principles and development of localized instructional materials. It could be a good practice for teachers to use the LLEX as remediation material to enhance the achievement of low-performing students. Since Mendelian Genetics was the last topic in the fourth quarter, it needs supplementary materials to cope with the lesson. Also, using the designed LLEX is commendable in teaching Mendelian genetics. It could be desirable for the administrators and Science supervisors to conduct workshops for teachers to develop the LLEX in all science lessons. Lastly, future researchers may conduct similar studies on the use of Localized Learning Exemplar in other disciplines to confirm the study results.

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