

Development and Validation of Inquiry-Based Learning Activity Sheets in Life Science

Jonalyn B. Cajayon¹ and Noel G. Benavides²

^{1,2}Sorsogon State University, Philippines

Email: ¹jonalyn.cajayon@deped.gov.ph and ²doctorengineer06@gmail.com

Abstract— In order for the student to achieve of one unit of content before moving on to another then the modular instruction has been introduced to individualize learning. This study aimed to develop and validate the inquiry-based learning activity sheets in Life Science for Grade 11 in HUMMS at Bulan National High School for school year 2021-2022. It used the developmental method of research. The respondents were the 25 Grade 11 HUMMS students in Bulan National High School which were purposively chosen and 5 experts teaching in science. The statistical tools utilized were the weighted mean, frequency, and t-test for dependent samples.

The study revealed that the developed inquiry-based learning activity sheets were successful in teaching basic science concepts as supplementary instructional materials. Experts firmly agreed that the instructional content for use in the home learning environment is appropriate and commendable. Also, the developed inquiry-based learning activity sheets are very evident that standards are followed and applied the appropriate pedagogies for the learning area as evaluated by the experts. Similarly, the developed inquiry-based Learning Activities Sheets in Life Science showed significant difference on the performance of the students as revealed in the pre-test and posttest results in terms of lessons in History and Development of the concept of life, Unifying themes, Animal Reproduction, Process of genetic engineering, and Benefits and Risks of using GMO.

It was recommended that the developed inquiry-based learning activity sheets in Life Science can be used to improve the retention and mastery of the lesson of the Grade 11 HUMMS students. The constant modification and revision on the developed learning activities sheets may be done to conform to the learning abilities, style and habits of the students. Test the effectiveness of the developed Learning Activities Sheets for Grade 11 HUMMS Life Science to the fast learners and other type of students identical to multiple intelligence. Future research on the creation of another instrument or collection of worksheets is encourage to reinforced in teaching various fields of science and across different disciplines at different grade levels.

Keywords— Development, Validation, Performance Level, Inquiry-Based.

I. INTRODUCTION

It has been a long pursuit of most educators to develop a method of teaching or a teaching strategy that will help improve the academic performance of their students. Programs that are responsible for faculty development keep on introducing alternative methods and in some cases requiring them to be used and applied in teaching. From the twentieth century up to now, there is a continuous evolution of teaching methods and strategies in order to find the best way of organizing contents to make learning much easier and more meaningful. This lengthy quest is never ending as it always needs to cater to the ever-changing field of teaching and learning processes.

The learners of the 21st century are posed to join a workforce that requires them to inquire, problem-solve, think critically, pursue investigation and share and apply their findings through multisensory lenses. Many of today's jobs require workers to think outside the box and consider solutions from different angles, always being

ready to construct and defend a new way of thinking. In order to provide the learners of today with the tools to participate fully in this challenging workforce, educators should have the understandings of teaching methodology so that learners will be fully equipped with necessary skills as they journey through life (Fortino, 2015).

Several issues are influencing the state of Science Education today. To note, the issue of insufficient instructional materials and teaching tools that are aligned with Department of Education's prescribed learning outcomes is one of them (Science Education International 30 (4), 284-290, (2019). Due to lack of relevant, responsive, and research based learning materials, teachers find it difficult to teach some concepts and principles.

The study of Tety (2016) on the Role of Instructional Materials in Academic Performance in Community Secondary Schools in Rombo District, Tanzania proved that instructional materials are the key to teachers' and

students' performance and that teachers should use different strategies to minimize the challenges of attaining and using quality instructional materials. The part played by instructional materials in achieving mastery of the content therefore, has a big impact on the learners' success in their studies.

Today's unique way of learning challenges educators to be resourceful, creative, determined, responsive and self-sufficient in order to encourage learners to continue education amidst this pandemic. This new normal pose threat to the education field in producing instructional materials to support learning and well-being, especially of the students. Teachers are tasked to provide quality resources such as Learning Activity Sheets to improve the learning outcomes. The development of this kind of material is based on the guidelines and criteria set by the department or bureau.

In the Philippines, the implementation of the K-to-12 program of the government expects senior high school students to be equipped with the mandatory skills for his or her future careers. Hence, effective and relevant teaching methods are necessary to realize those skills. To support this mission, the Section 10.2 (d) and (h) Implementing Rules and Regulations for R.A. 10533 Enhanced Basic Education Act of 2013 explicit that "The curriculum shall use pedagogical approaches that are constructivist, inquiry-based, reflective, collaborative and integrative". Republic Act No.9155 Section 2 declared the policy of the State to protect and promote the right of all citizens to quality basic education such education accessible to all by providing all Filipino children a free and compulsory education in elementary level and free education within the high school level include alternative learning skills, knowledge and values they need to become.

The DepEd Order No. 39, S.2016 entitled, Adoption of the Basic Education Research Agenda, has an undertaking for learners to find out in an exceedingly child-friendly, gender sensitive, safe and motivating setting. To realize this, DepEd urges educators to conduct evidenced-based studies under their research agenda. The development of Inquiry-based Learning Activity Sheets is in unison with the D.O. No.39, s.2016, under research agenda Theme 1: Teaching and Learning, wherever educators are inspired to study different teaching methods, develop lesson plans and make educational materials.

The curriculum framework for science powerfully advocates the philosophy of constructivism, multidisciplinary/ knowledge base approach, contextualized learning, and inquiry-based approach. The program clearly outlined that inquiry-based

pedagogy can be a teaching- learning technique of science that may change the learners to create connections, draw conclusions or generalizations, explore and work collaboratively, discuss specific information in a very sort of ways in which they use multiple intelligences thus they're going to become engaged and empowered learners who will take possession of their own learning (K to 12 Toolkit, 2012; K to 12 Science Curriculum Guide, 2013).

The Organization for Economic Co-operation and Development (OECD)(2016)states that the gap is increasing between the production of scientific expertise in school and societies' needs. This resulted from societies' increasing demand for people trained in the field of science while number of students taking the course is decreasing. In fact, they observed a decline in science literacy of about 1.4 points for every three years in 64 countries (OECD,2016). This shows that there is really a need for educators to come up with a strategy which may entice students to go for science education.

Economy is dependent on education (Philmckinney, 2017). As our society continuously change, education should also change. By exploring new and better ways to educate students, teachers may positively affect future economy and society. Moreover, to improve science education, teachers should collaborate with each other in improving scientific knowledge and skills (Human Genome Research Institute, 2012). Further, educators have to design processes that involve students' mental, physical and emotional processes. To address the above issues and concerns in science education., this study developed an inquiry-based learning activity sheets in life science to deliver quality education.

Jalmasco (2014) pointed out that the lack of suitable instructional materials and other devices that the teacher can use in teaching all over the country resulted to poor performance of the students in the National Achievement Test. This failure is also connected to the fact that instructional materials that are aligned with the target competencies are scarce.

The researcher, who is a senior high school science teacher at Bulan National High School, is confronted with the same scenario stated above. From S.Y 2018-2019, an alarming result was noted on the performance level of students along Earth and Life Science. Only 65% PL was attained by the learners and 68% PL in the next school year. With these results, the need to conduct a study to investigate the problem and come up with concrete steps to remedy this unacceptable result is indeed inevitable.

To solve this issue, the researcher conducted this study to aid the learners develop their scientific skills, which

is a significant aspect in today's continuous adaptation to the real world. The development of the inquiry-based approach learning activity sheets along the identified topics would enable learners embrace Science as a powerful tool to combat challenges of this ever-changing world.

It is for these reasons that the researcher developed Learning Activity Sheets in Life Science integrating Inquiry Based Learning. This action aims to meet the skills needed by Senior High school students and to facilitate more effective instruction in concretizing abstract concepts in Life Science thus, maximizing the learning experience through the developed LAS. Despite the limited resources in the public secondary setting, the researcher believed that this study may help the Senior High School students in preparing them to become holistically developed Filipinos with 21st century skills ready for employment, entrepreneurship, middle-level skills development and higher education amid pandemic.

Statement of the Problem

The study aimed to develop and validate the inquiry-based learning activity sheets in Life Science for Grade-11 HUMMS at Bulan National High School for school year 2021-2022.

Specifically, it sought answers to the following problems:

1. What inquiry-based learning activity sheets may be developed in Life Science along the following topics:
 - a. History and Development of the concept of life;
 - b. Unifying Themes;
 - c. Animal Reproduction;
 - d. Process of Genetic Engineering; and
 - e. Benefits and Risk of Using GMO?
2. What is the validity of the developed learning activity sheets based on DepEd LRMDS along:
 - a. content and
 - b. mechanics?
3. How effective are the developed learning activity sheets in improving the performance level of the students?

II. METHODOLOGY

This study aimed to develop and validate the inquiry-based approach LAS in life science for grade 11 HUMSS students. Generally, descriptive-developmental research method is the design in which this study was anchored.

Seels and Richney, (1994) Developmental Research method pertains to designing, developing and evaluating instructional processes and products in a specific manner, meeting the criteria of internal consistency and effectiveness. On the other hand, descriptive research design is defined as a basic research method that examines currently existing phenomena (Leedy and Ormrod, 2001). Specifically, this study employed observational and survey research to collect data from experts using Evaluation checklist based on DepEd LRMDS.

Mixed method approach was utilized to explain the development and validation of LAS in life science. This specifically utilized Sequential Explanatory Design which is characterized by the collection of quantitative data followed by the qualitative data, where the latter supports the findings and explanations of the former (Creswell, 2003). By this, weaknesses of both quantitative and qualitative approaches were balanced, making the study explore various ways to analyze data. In addition, one-group pretest and posttest pre-experimental design was used to obtain quantitative data, specifically to investigate the intervention pertaining to the utilization of LAS.

DEVELOPMENT AND VALIDATION OF INQUIRY-BASED LEARNING ACTIVITY SHEETS IN LIFE SCIENCE

1. Development of Inquiry-based Learning Activity Sheets (LAS)

This section discusses the development of inquiry-based learning activity sheets along history and development of the concept of life, unifying themes, animal reproduction, process of genetic engineering, and benefits and risks of using GMO. The topics and competencies included were based from the most essential learning competencies in life science such as: 1) Explain the evolving concept of life based on emerging pieces of evidence (S11/12LT-11A-1) 2.) Describe how unifying themes (e.g., structure and function, evolution, and ecosystems) in the study of life show connections among living things and how they interact with each other and with their environment (S11/12LT-11A-3) 3.) The learners describe the different ways of how representative animals reproduce (S11/12LT-IIej-15) 4.) Describe the process of genetic engineering (S11/12LT-IIej-17) 5.) Evaluate the benefits and risks of using GMOs (S11/12LT-IIej-19).

The developed learning activity sheets followed the 7E's instructional model with the following parts: Elicit Engage, Explore, Explain, Elaborate, Evaluate and Extend. The developed LAS have also the features of

inquiry-based strategy. Each LAS contained the basic parts of the LAS based from the Regional Memorandum No. 86 s.2020 such as the Header, Introductory Concept, Learning Skills from the MELC, objectives, activities, reflection, rubric for scoring, answer key and reference.

Header. This part contained the school logo, learning activity sheet number, name of the student, grade level, date and the title of the LAS. It allows teachers to track the identity of the students and keep the necessary data intact and organized.

Introductory Concept. It gave the preview of the concepts and ideas included in the LAS. The fundamental processes and the main ideas are introduced in a very simple way in this part.

Most Essential Learning Competency. This part shows the objectives taken from the most essential learning competencies of the learning area. Further, it includes the code of the MELC from the curriculum guide. It enables the teachers to focus instruction that all learners must acquire.

Objectives. This part provided the specific statements that the learners are expected to do at the end of a lesson as a result of the activities, teaching and learning has taken place.

Activities. This was the core of the LAS, In this part you can see the activities that would answer the objectives deduced from the most essential learning competency. It presents different activities that may deepen the learner's understanding of a skill or concept. Inquiry based approach was utilized to activate learner's senses for maximum learning. The activities followed the 7E's instructional model.

Reflection. The overall impressions and feelings of the students were reflected in this part. Thus, the learner's responses on what they think they have learned, what part they enjoyed the most and what they want to learn more were stated in this phase.

Rubric for scoring. It displays the different points that explicitly represent the performance expectation of the learners for the given activity. Further, it serves as teacher's bases to evaluate performance.

Answer Key. It contained the possible answers in the different activities in the LAS. It may help the students verified whether their answer was correct or not.

Reference. It shows the various sources that provide background information or quick facts on the given topic. Further, it allows learners to determine which reference materials are needed to locate specific types of information.

In developing the LAS, the following salient features were considered:

2. Learning Activity Sheet 1

LAS 1 was entitled "History and Development of the Concept of Life". It addressed the competency explaining the evolving concept of life based on emerging pieces of evidence. The focus of this LAS was describing and explaining the different theories about origin of life on earth through the use of inquiry based approach.

Tapping student's prior ideas is utmost in inquiry-based learning. Probing questions were asked to elicit students' ideas about how life on earth first begins.

In the engage phase, an activity entitled "Arrange Me! I'm Confused!" were utilized to motivate the students in the topic. In this activity, students have to arrange the given events on how life on earth begins in chronological order.

Picture analysis was shown in the explore phase and guide questions to facilitate learning. The guide questions were aligned to the learning objectives. Inquiry based approach was utilized in this activity by means of letting the students performed an activity that used critical thinking.

In the explain phase the different concepts and theories about the development and history of life were included to attain the most essential learning competency. This guides the students on the important concepts about the topic. On the other hand, the concepts and illustrations of explain part was obtained from module of the region and from internet sources.

Focused questions as shown in the elaborate phase were presented to deepen the understanding of the students about the topic. The answers to the questions posted were tackled in this phase.

In the evaluate phase, the researcher made three items multiple choice questions to assess the learning's of the students. The questions were based on the curriculum's given competency. Rubrics for scoring were provided.

Activity in the extend phase were made to apply students' understanding of the concepts in a real life setting as shown in plate 1. Simple directions were given to facilitate home learning. Thus, inquiry based approach was utilized in this activity through exploration

Learning Activity Sheet 2

LAS 2 was about unifying themes in the study of life, the second topic in life science. To activate student's prior knowledge about the topic, an activity in the elicit

part were provided. Inquiry based approach takes place in this activity by letting the students observed their surroundings and students may use their critical thinking to choose a particular scenario that pictures the value and definition of life.

The activity in the engage phase exhibits inquiry-based approach, thus it promotes curiosity to the learners. Venn diagram was used in the activity to describe the similarities and differences of the two organisms available in the student's locality.

Observation skills of the students were needed to accomplish the activity in the explore part. Different photographs were provided, and the students are expected to write their observations of the characteristics of life being portrayed in the different photos. The concepts and the illustration in the explore part were obtained from internet sources and Life science curriculum guide (CG) and teacher's guide (TG).

On the explain phase, the proponent provided a focused question "What is a theme?" before introducing the different concepts and the ten unifying themes of life. The focused question may guide the learners' in understanding the lesson. Concepts and illustration in this phase were adopted from internet sources and Curriculum Guide.

The learners were expected to answer the given questions in evaluation phase. The assessment given was parallel to the objectives and activities. Illustrations and concepts were obtained from the internet sources.

Learning Activity Sheet 3

The LAS 3 was entitled "Animal Reproduction", the third topic in life science. The focus of this LAS was to describe the different ways of how animals reproduce.

The manner of presenting the elicit part was in the form of concept map. The students were expected to describe the word reproduction based on their prior knowledge. The study of Alber (2011) stated that learning's progresses primarily from prior knowledge, and only secondarily from the materials the teachers presented to students.

In the engage part, the researcher made an activity that may enhance the critical thinking of the students by the use of available resources in their locality. Students were expected to observe animals in their locality and investigate on how those animals reproduce and develop.

Activity and illustrations in the explore part were obtained from the module of the Region V provided by the Department of Education but the guide questions

were made by the researcher to deepen the students understanding of the topic. Thus, inquiry-based approach was applied in this phase by letting the students explore topics to learn.

In the explain phase, concepts and illustrations were adopted from the curriculum guide, teaching guide and internet sources. Reproduction of animals and the types of reproduction were discussed in this phase to address the learning competency. Additional information was presented in the elaborate phase. Concepts and illustrations were obtained from the internet sources. Illustrations on how a representative animal reproduce and develop were shown to attract the student's interest.

In the evaluate phase, assessment was provided to examine the understanding of the students. Assessments were congruent to the learning objectives.

Learning Activity Sheet 4

LAS 4 was entitled "Process of Genetic Engineering". It focused on the topic about genetic engineering. Students were expected to describe the process of genetic engineering. In the elicit phase, a simple recall about DNA were presented to guide the learners in the present topic. Illustration of DNA was presented.

Questions were made by the researcher in the engage phase to increase the attention and focus of the learners. Students were tasked to share their ideas about manipulating DNA and how the scientist make changes to DNA. Illustration of the major processes of genetic engineering was presented. Further, inquiry-based approach was used in this phase to motivate students and practice higher-level critical thinking skills.

In the explore phase, illustration was obtained from internet and the guide questions were made by the researcher. The guide questions were made to let the students discover their learning's from the given illustration.

Information in the explain phase were acquired from the curriculum guide and internet sources. Integration of the concepts was presented to give the students the necessary information about the topic.

Questions in evaluate phase were made by the researcher. A graphic organizer was used to identify the basic DNA technology used to construct recombinant DNA. A 3 items identification test in part 2 was made and for part 3 students were tasked to cite applications of genetic engineering in the fields of medicine and agriculture.

Activity was made to assess the viewpoints of the students in cloning animals in the extend phase. Rubric for scoring was provided.

Learning Activity Sheet 5

LAS 5 entitled “Benefits and Risks of Using Genetically Modified Organisms (GMOs). The students may learn about the advantages and disadvantages of the genetically modified organisms for them to evaluate the benefits and risks of using GMO.

A short recall in the elicit phase about genetic engineering was made by the researcher but the concepts and the activity about product survey were obtained from the internet sources. Students were assigned to look for GMO and non-GMO labels from various products available in their home through its packaging.

The concepts and illustrations in the engage phase were adopted from the module of region v and internet sources. Students were likely to observed different agricultural products shown and write their observations.

The activity in the explore phase is all about the issue on the unintended impacts on other species: The Bt corn Controversy was acquired from the internet sources and the researcher made the guide questions to incorporate the inquiry-based approach. Students were going to analyze and read the given issue and answer the following guide questions: 1). what are the risks and benefits of genetically modified crop, like Bt corn? 2). Do you think GM crops need tighter regulations? Why or why not? Rubric for scoring was provided.

Concepts and illustrations were adopted from the curriculum guide, teaching guide and internet sources. Discussions of the topic were made in this phase to deepen the understanding of the students.

In the elaborate phase the researcher discussed the advantages and disadvantages of GMO and the risks of using GMO. The information was obtained from the internet sources.

The researcher showed examples of genetically modified rice crop, corn and banana. Illustrations were taken from the internet sources. Learners were expected to list down the advantages and disadvantages of genetically modified agricultural products and asked their ideas if they are going to patronize genetically modified rice crop.

Through the given venn diagram, in the extend phase students were tasked to state the differences and similarities of the arguments for Pro-GMOs and anti-GMOs. In this activity students may investigate different facts about the topic.

In summary, inquiry based was used in the developed learning activity sheets as a method to engage students in an investigations and observations. Inquiry questions

were asked at the start of every topic to guide students in the conduct of inquiry. This was related to the study of Lee, (2019) stated that inquiry-based approach provides the learners to be engaged in meaningful learning. The approach has its roots in constructivism which states that students learn by constructing ideas from experience. This may help the students used their prior knowledge in constructing new ideas.

Another theory on which this study was based on was the contextual learning theory of Hull (1993). According to this theory, learning occurs only when students process new information or knowledge in such a way that it makes sense to them in their own frames of reference (their own inner worlds of memory, experience, and response).

In this study, the sequence of phases in the 7E learning model employed was: Elicit (recall of prior knowledge); Engage (recall of prior knowledge and motivation); Explore (discovery by investigation); Explain (analysis); Elaborate (applying); Evaluate (assessment) and Extend (transfer of learning). 7E’s is an inquiry-based approach model that actively engages learners in each phase of learning (Eisenkraft, 2003). Ranera (2017) conducted a study on the use of 7E learning model and project-based learning (PBL) in teaching science concluded that learning activities developed using the 7E learning model and Project-Based Learning were effective in enhancing the students’ mastery of Science concepts and basic science process skills.

The used of inquiry-based approach in the developed LAS aims to improve the level of performance of the students in life science. Moreover, it may serve as an additional inquiry based and instructional materials to enhance the learning of the students.

2. Validation of the developed Learning Activity Sheets (LAS) based on DepEd Learning Resources Management Development System (LRMDS)

This part encompasses the validation of the developed learning activity sheets using the DepEd LRMDS along content and mechanics. The said validation was made by 5 master teachers and teachers teaching in science with 5 years teaching experience and above. It was scrutinized and rated based on DepEd LRMDS along content and mechanics. The experts also suggested and gave comments for further improvement of the LAS in which the researcher considered in the development of valid LAS.

Content. The need to develop content-based instructional materials is necessary in attaining mastery of the learning competencies. Teachers usually consider this as an important feature of any learning resources

since this is the foundation in the development of any materials to be introduced to the learners. It is indeed a

must for teachers to see to it that this element is considered for the success of students' learning.

Table 1A: Validation of Developed LAS Along Content

Indicators	Weighted Mean	Interpretation
1. Learning objectives are anchored on the MELC.	5.00	Very Evident
2. Learning objectives are appropriately sub-tasked for the lesson.	5.00	Very Evident
3. The LAS provides an appropriate introduction on what learners are expected to do and learn in the lesson.	4.92	Very Evident
4. The LAS provides an activity, task or complementary material that will enhance the learner's understanding of concepts.	5.00	Very Evident
5. Activities in the LAS are LAS are logically-sequenced and arranged from simple to complex.	5.00	Very Evident
6. The number of activities is "just enough" and appropriate to meet the individual learning needs of learners.	4.92	Very Evident
7. The LAS provides varied and interesting activities.	4.92	Very Evident
8. Questions and tasks allow for development of higher order thinking skills.	4.72	Very Evident
9. The directions for activities are simple and clear to guide learners or home learning facilitators.	4.93	Very Evident
10. The LAS provided assessment strategies that are aligned with the lesson objectives.	4.92	Very Evident
11. A rubric is provided for assessment strategies that require for it.	5.0	Very Evident
12. Sources references, supplementary and complementary materials including images and graphics used in LAS are cited.	4.92	Very Evident
Overall Weighted Mean	4.94	Very Evident

Table 1A presents the validation of LAS along content and includes the twelve (12) indicators, weighted mean and interpretation of the validation of the developed LAS using the DepEd LRMS along content.

From the table, it can be observed that the developed LAS are very evident that they follow the standards and apply the appropriate pedagogies for the learning area as manifested by the overall weighted mean of 4.94. Looking at each indicator, it can be noted that the experts unanimously rated the 5 LAS with weighted mean that ranges from 4.72 to 5 which is interpreted as very evident. It further revealed that indicators 1, 2, 4, 5, and 11 got a perfect weighted mean of 5, however, the remaining indicators although differ in weighted mean are still in the scale of 5 which is interpreted as very evident.

The findings indicate that the learning activity sheets developed are sufficient for the level of development of the learner, contribute to the achievement of specific goals, free of biases and prejudices, promote the growth of creativity and innovation, communication, teamwork, competitiveness, accountability, leadership and responsibility. The overall assessment of its effectiveness showed that the learning activity sheet is highly accessible as an established instructional material in the teaching of basic science concepts. The learning activity sheets have a high degree of acceptability and effectiveness, the expert-evaluators concluded. In a

specific definition, the experts considered the content as possible instructional materials to improve the performance of learners.

The result is similar with the study of Monding and Bunel (2021) which concluded that the worksheets produced were successful in teaching basic science 9 concepts as instructional materials. Experts firmly agreed that the instructional content for use in the classroom environment is appropriate and commendable. In addition, the students were able to appreciate the topic in an interesting way through the developed worksheets as the result of increase in their performance.

To further support the findings presented, the researcher included the comments of the experts and validators of the developed LAS and they are presented through plates.

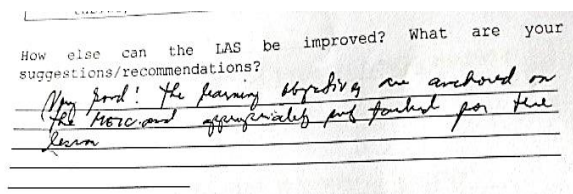


Plate 1: Comment of Expert 1

Plate 1 presents the comment of Expert 1 in relation to the validation of developed LAS along content. This comment particularly relates to indicators 1 and 2 which

state that learning objectives are anchored on the MELC and are appropriately sub-tasked for the lesson.

This remark is definitely helpful to ensure that the researcher was able to develop LAS that are in line with learning competencies. In addition, it is good to note that the learning competencies are sub-tasked to provide focus, set boundaries on what students should master and met the time allotted for the learning. The strength of the developed LAS in this particular aspect is undeniably shown in the comment presented and the result of indicators 1 and 2 which has a weighted mean of 5.00 that is interpreted as very evident.

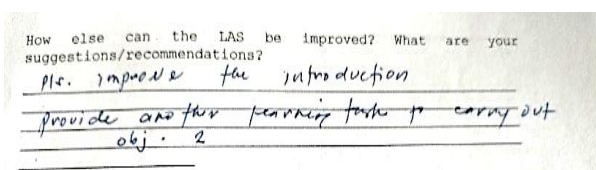


Plate 2: Comments of Expert 3

The above plate displays Expert 3' comment on LAS in relation to indicators 3 and 4 which center on the element that LAS should provide an appropriate introduction on what learners are expected to do and learn in the lesson. Moreover, indicator 4 states that LAS should also provide an activity, task or complementary material that will enhance the learner's understanding of concepts.

Taking into account, Expert 3' comment allowed the researcher to assess what needs to be improved in the introduction since it is a very significant part of LAS. If learners were able to understand clearly what they would meet and master in specific LAS, they would be guided accordingly and would be given ideas on what are expected of them.

In addition, Expert 3 remarked that there is a need to provide additional learning task to carry out objective 2. This observation is truly essential because as indicated in indicator 6, there must be enough activities to meet the individual learning needs of the learners.

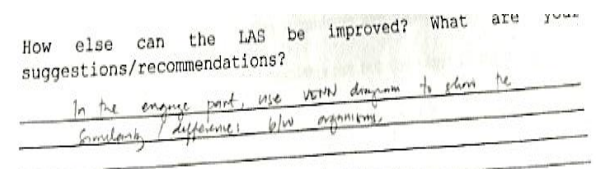


Plate 3: Comment of Expert 2

Plate 3 shows the comment of Expert 2 in line with validation of developed LAS along content. This comment jibes with indicator 6 and 7 that state that the number of activities is just enough and appropriate to meet the individual learning needs of learners and that the LAS should provide varied and interesting activities.

Considering this comment would allow the researcher to align the activities with the objectives in the developed LAS and eventually making them suited to the needs of the learners in order to attain mastery of the learning competencies.

As exposed in the weighted mean of indicator 6 and 7 which is 4.92, there is a need to reflect on this aspect so as to come up with an output that would be learner-centered and that can be realized through content-based instructional materials. As a result, the researcher gave emphasis on these facets during the revision of the manuscript.

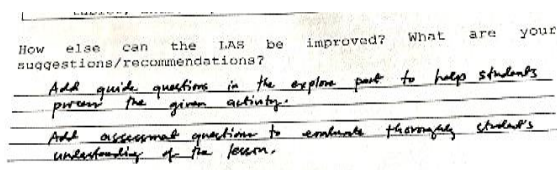


Plate 4: Comments of Expert 2

The plate above presents comments of Expert 2 regarding validation of developed LAS along content. This precise observation is connected to indicators 9 and 10 of Table 2A which states that the directions for activities are simple and clear to guide learners or home learning facilitators and that LAS should provide assessment strategies that are aligned with lesson objectives.

Since guide and assessment questions are vital in any teaching-learning process, Expert 3 suggested that these parts be given emphasis by the researcher. In doing so, learners will be guided systematically on the concepts they absorbed and realized. In the same manner, assessment questions if given correctly and effectively would let students arrive at an accurate generalization at the end of the lesson. Interestingly, the researcher took these comment positively as shown in the final output of this study.

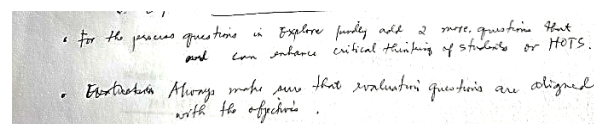


Plate 5: Comments of Expert 4

Presented above is the plate 5 which exhibits the comments of Expert 4. It is noticeable that these comments are in relation to indicators 8 and 10 of Table 1A. As stated in the said indicators, questions and tasks allow the development of higher order thinking skills and that the LAS should provide assessment strategies that are aligned with the lesson objectives.

Expert 4 comments are really valuable in the accomplishment of the developed LAS in this present study. It cannot be denied that process questions are

truly significant to let learners understand the concept. Clear and sufficient process questions would encourage learners to understand the lesson systematically and discover the ideas logically. Furthermore, teachers' art of questioning would deepen learners' grasp of the concept since follow up questions are necessary to assess whether learners comprehend the lesson. In this manner, the higher order thinking skills of the learners are enhanced and mastery of the learning competencies are attained.

In essence, to guarantee that these aspects are given attention, the researcher make some changes in the LAS as reflected in the accomplished instructional materials.

Mechanics. Instructional materials to be presented to the learners should possess certain characteristics to warrant its effectiveness especially on the part of the clientele. Teachers should know that the procedure in crafting any learning resources should be taken into consideration for after all the main objective in developing instructional materials is to aid learners develop their love for learning.

Table 1B contains the weighted mean and interpretation of the validation of the developed learning activity sheets using the DepEd LRMS along mechanics. The data revealed that the developed learning activity sheets evidently followed the mechanics prescribed in the LRMS as evaluated by the identified experts with an overall weighted mean of 4.94. All the indicators in the instrument have very evident assessment with weighted mean ranging from 4.72 to 5.00.

It can be deduced from the table that the weighted mean of indicator which states that, the LAS uses vocabulary that are within the learners' level of competence in the language used was 4.80. The researcher understood why the LAS did not get a perfect score as reflected in the expert's suggestion. The expert might perceive that some activities were still difficult for the students to understand.

The result implies that the said developed learning activities sheets can be effective in understanding the concepts. It should carry over the characteristics that would really help the users in the improvement of the teaching learning process. The study confirms the finding of the study of Perez (2017), that organization and presentation of the lessons evaluated by the students and instructors are very much accepted. Also, Tambongco (2021), found out that the evaluation of the students and instructors have the same evaluation on language and style of the different concepts of the developed material. The above-mentioned studies are all relevant to the present study since all dealt in providing instructional materials which are relevant, well presented and organized, language is clear, effective, and useful that will somehow help the students in studying Science mechanics.

How else can the LAS be improved? What are your suggestions/recommendations?

Edit some of the direction to make them clear and understandable.

Plate 6: Comment of Expert 3

Table 1B: Validation of Developed LAS Along Mechanics

Indicators	Weighted Mean	Interpretation
1. The LAS uses vocabularies are within the learner's level of competence in the language used.	4.80	Very Evident
2. The length and structure of sentences are appropriate to the learners.	5.00	Very Evident
3. The LAS is free from grammatical, factual and computational errors.	4.92	Very Evident
4. LAS is free from violations of social content guidelines.	5.00	Very Evident
5. The total number of pages of the LAS is sufficient to carry out the intended lesson.	4.84	Very Evident
6. The ready-to-print LAS is properly encoded and laid-out according to required specifications for grade level.	5.0	Very Evident
7. The electronic LAS is formatted to be accessible and usable in any electronic device.	5.00	Very Evident
Overall Weighted Mean	4.94	Very Evident

The data revealed that the developed learning activity sheets evidently followed the mechanics prescribed in the LRMS as evaluated by the identified experts with

an overall weighted mean of 4.94. All the indicators in the instrument have very evident assessment with weighted mean ranging from 4.72 to 5.00.

It can be deduced from the table that the weighted mean of indicator which states that, the LAS uses vocabulary that are within the learners' level of competence in the language used was 4.80. The researcher understood why the LAS did not get a perfect score as reflected in the expert's suggestion. The expert might perceive that some activities were still difficult for the students to understand.

The result implies that the said developed learning activities sheets can be effective in understanding the concepts. It should carry over the characteristics that would really help the users in the improvement of the teaching learning process. The study confirms the finding of the study of Perez (2017), that organization and presentation of the lessons evaluated by the students and instructors are very much accepted. Also, Tambongco (2021), found out that the evaluation of the students and instructors have the same evaluation on language and style of the different concepts of the developed material. The above-mentioned studies are all relevant to the present study since all dealt in providing instructional materials which are relevant, well presented and organized, language is clear, effective, and useful that will somehow help the students in studying Science.

Plate 6 shows the comment of Expert 3 in accordance to validation of LAS along mechanics. It is very obvious that this comment conforms with indicators 1, 2, and 3 in Table 1B which states that the LAS should use vocabularies that are within the learners' level of competence in the language used, the length and structure of sentences are appropriate to the learners and the LAS should be free from grammatical, factual and computational errors.

Expert 3 emphasized the need to make directions clear since teachers could not expect correct responses from the learners if they do not understand the given directions. For directions to be clear and understandable, they must be concise, use simple words, free from grammatical errors and well-structured. Sometimes this part is not given weight, however, delving deeper into its importance, effective directions would lead learners to do properly what they need to accomplish and would ultimately produce high quality performance, correct responses and excellent output. The researcher, knowing the significance of this observation, acted on the matter and made some revisions in the output.

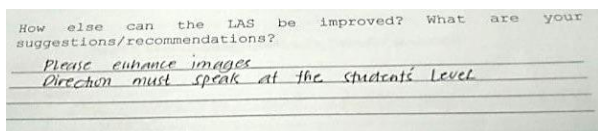


Plate 7: Comments of Expert 5

The above plate presents the comment of Expert 5 on the validation of LAS along mechanics. This particular remark adapts indicators 1 and 2 of Table 1B that center on LAS that must use vocabularies that are within the learners' level of competence in the language used and that the length and structure of sentences are appropriate to the learners.

This observation is indeed a manifestation that visible and clear images and the effective use of language have bearing to students' learning of the subject matter. Students would only appreciate learning tools that are within their grasps and familiarity. Looking at distinct images would broaden students' imagination and understanding of things and reading familiar and simple words would definitely mean absorbing ideas from the printed texts.

With the need for some revision on the developed LAS along mechanics and the result presented in Table 1B, the researcher did some changes on the suggested parts as apparently seen in the output of this study.

3. Effectiveness of the Developed Learning Activity Sheets

Teachers' role in the teaching-learning process is truly critical for they can make or unmake learners to learn. One of the many roles they have to face is developing instructional materials that are suited to the learners' level of comprehension, learning needs and individual differences. That is why, it is a must for teachers to be creative, talented, updated, resourceful and dedicated at work. Table 2A contains the mastery level of the students in the pre-test and posttest in using the developed learning activity sheets of the selected topics.

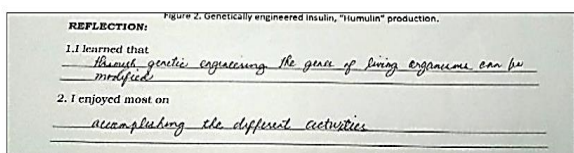
The data revealed that the students have average mastery level in the five developed learning activity sheets with mean ML of 45.2. All the five developed LAS provided an average mastery level as manifested in the data. On the other hand, the students attained a mean ML of 76.4 in the post-test which is described as moving towards mastery with all the five learning activity sheets having similar mastery level. Meanwhile, the significant change in the pre-test and post-test scores obtained by students before and after they were exposed to the developed learning activity sheets signifies that the instructional modules brought out some sort of improvement in their knowledge of the selected topics. That is, the students learned from the modules and can go about it, with their teachers as facilitators of learning

The findings also show that with the use of the developed learning activity sheets and the conventional teaching approach, there is a significant difference between the pre-test and post-test results of the

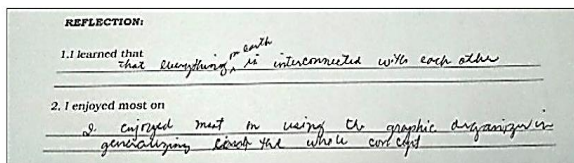
respondents in the teaching of science concepts. The result is also supported by the Erkus (2017) report, which notes that the use of visual and text style

Table 2A: Pre-test and Post-test Performance of the Students

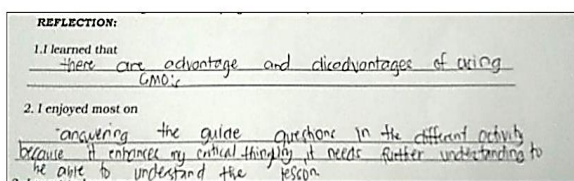
Topics	Pre-test		Posttest	
	ML	Description	ML	Description
History and Development of the Concept of Life	42	Average	75	MTM
Unifying Themes	50	Average	79	MTM



Reflection of student 3



Reflection of student 5



Reflection of student 6

Plate 8: Reflections of Students 3, 5,6

Shown above is Plate 8 which displays the reflections of students 3, 5, 6 along the effectiveness of the developed LAS. Varied answers were given in relations to the learnings they got from the developed LAS. Their answers conform with the different topics/lessons in Life Science such as Process of Genetic Engineering, History and Development of the Concept of Life, Unifying Themes, Animal Reproduction and Benefits and Risks of GMO.

It is noted that Student 3 realized that through genetic engineering the genes of living organisms can be modified. Also, Student 5 learned that everything on earth is interconnected with each other. In addition, Student 6 came to know that GMO has its advantages and disadvantages

With these data presented, it is apparent that the developed LAS are effective since learners are confident enough in proclaiming that they learned something from

presentation gives worksheets the opportunity to get away from conventional classroom delivery modes using traditional method of teaching.

Animal Reproduction	49	Average	79	MTM
Process of Genetic Engineering	43	Average	74	MTM
Benefits and Risks of using GMO	42	Average	75	MTM
Mean ML	45.2	Average	76.4	MTM

Legend: ML-Mastery Level; MTM-Moving Towards Mastery

the LAS given to them. Moreover, the students even stated what they loved/enjoyed in answering the LAS and it can be concluded that the learning activities found in that instructional materials are student-centered, competency-based and enhances higher order thinking skills.

Table 2B: Difference Between Pre-test and Post-test of the Students

Statistical Bases	Statistical Analyses
Degrees of freedom	24
Level of significance	0.05
t critical value	2.06
t computed value	18.53
Decision on Ho	Reject
Conclusion	Significant

Table 3B presents the statistical bases and statistical analyses of the difference between the pre-test and posttest of the students in using the developed learning activity sheets. The t-test for dependent samples was used in testing the difference whether significant or not.

It can be inferred from the table that the t computed value of 18.53 is greater than the t critical value of 2.06 at 0.05 level of significance with degrees of freedom of 24. Therefore, the rejection of the null hypothesis which states that there is a significant difference between the pre-test and posttest scores of the students. Since the mean posttest score is greater than the mean pretest score, this implies that there is sufficient evidence to conclude that the exposure to the developed instructional modules generally brought about improvement in the knowledge of students.

The findings demonstrate that the use of a well-designed learning activity sheets can be effective in improving students' knowledge and understanding of the selected topics. The significant differences between the mean

pretest and posttest scores are in the affirmative, showing the effectiveness of the developed learning activity sheets. This is consistent with earlier findings that show how instructional materials can assist the teachers in presenting their lessons logically and sequentially to the learners (Isola, 2010) and as supported by Abdu -Raheem (2014) who showed how instructional materials aid explanations and make learning of subject matter understandable to students during the teaching and learning process.

Plate 9 presents parts of the pre-test and post- test result of Student 1 and 2. It is evident that in the pre-tests both students were not able to get the correct answers. However, after the presentation of LAS to them, significant changes are observed that is, they were able to get the answer correctly

This plate 9 jibes with the findings presented in Table 2B and therefore concluded the rejection of the null hypothesis which states that there is a significant difference between the pre-test and posttest scores of the students. It further concluded that the researcher-developed instructional materials generally brought about positive changes in the academic performance of the students. Finally, it can be stated that the developed LAS is effective in developing the mastery level of students in Life Science.

Directions: Which theme of life is being described by each statement? Refer to the box. Write the letter of your answer on the space provided.

- 1. Wings of birds are made for them to fly
- 2. "Like begets like"

Pre-test of Student 1

Directions: Which theme of life is being described by each statement? Refer to the box. Write the letter of your answer on the space provided.

- 1. Wings of birds are made for them to fly
- 2. "Like begets like"

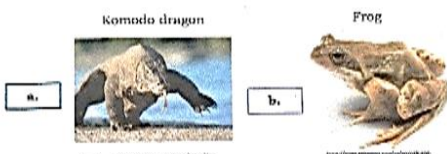
Post-test of Student 1

- 4. This organism reproduces through external fertilization where in the union of eggs and sperm occurs outside the female reproductive tract.
- 5. It reproduces by internal fertilization within which the fusion of gametes take place inside the body.



Pre-test of Student 2

- 4. This organism reproduces through external fertilization where in the union of eggs and sperm occurs outside the female reproductive tract.
- 5. It reproduces by internal fertilization within which the fusion of gametes take place inside the body.



Post -test of Student 2

Plate 9: Pre-test and Post-test Results of Students 1 and 2

CONCLUSION

Based on the findings of the study, the researcher arrived at the following conclusions:

1. The developed inquiry-based learning activity sheets in life science were history and development of the concept of life, unifying themes, animal reproduction, process of genetic engineering, benefits and risks of using GMOs utilizing 7E's gives towards the attainment of most essential learning competencies.
2. The developed inquiry-based learning activity sheets are valid along content and mechanics.
3. The developed inquiry-based Learning Activities Sheets in Life Science showed significant difference on the performance of the students as revealed in the pre-test and posttest results in terms of lessons in History and Development of the concept of life, unifying themes, Animal Reproduction, Process of genetic engineering, and Benefits and Risks of using GMO.

RECOMMENDATIONS

Based on the results and in the light of the findings and conclusions drawn, the following recommendations are proposed:

1. The developed inquiry-based learning activity sheets in Life Science may be further enhanced through integration of contextualization in order to improved the performance of the learners.
2. The constant modification and revision on the developed learning activities sheets may be used in teaching life science to develop the desired competencies.
3. The effectiveness of developed inquiry-based learning activity sheets may be further tested using a robust experimental design.
4. Future research on the development and validation of instructional materials is encouraged to reinforce in teaching various fields of science and across different disciplines at grade levels

ACKNOWLEDGMENT

The researcher would like to extend her profound gratitude and appreciation to those people who supported and encouraged her to complete this study.

REFERENCES

Published Materials

- [1] Abdii, A. (2014). The Effect of Inquiry-Based Learning Method on Students' Academic

- Achievement in Science Course. Retrieved on July 2021 from <http://www.hrpub.org>
- [2] Angara to Filipinos: Create our future through science, technology and innovation. Available from www.ateneo.edu.
- [3] Arias, A.M., Smith, P.S., Davis, E.A., Marino, J.C., Palcinar, A.S. (2017). Justifying predictions: Connecting use of educative curriculum materials to students' engagement in science argumentation. *Journal of Science Teachers Education*, 28(1), 11-35.
- [4] Byker, C., Harder, G.et.al., (2017) Hoping to teach someday Inquire within; examining inquiry based learning first semester undergrad. *Journal of Inquiry and action in Education*, 8 (2), 54-80.
- [5] Catalina Fortino (2015) "Critical thinking and Problem Solving for the 21st century.
- [6] Creswell, J. W. (2003). *Research Design: Qualitative, quantitative approaches, and mixed methods approaches*. Thousand Oaks, CA:Sage
- [7] Cruz, E. (2015). Evaluation of worktext in mechanical drafting. *Asia Pacific Journal of Multidisciplinary Research*. 3(4), 109-117)
- [8] Dio, R.V. (2017). Number theory worktext for teacher education program. *The normal Lights*. 11(2), 143-179
- [9] D.O. No. 39 s. 2016. Adoption of the Basic Curriculum Guide (2013)
- [10] Duran & Dokme (2016). "The Effect of the Inquiry-Based Learning Approach on Student's critical thinking Skills"
- [11] Funa, Aaron (2019) Development and Validation of Gamified Instructional Material in Genetics for Grade 12 STEM
- [12] Ghaemi, F & Mirsaed, S. (2017). The impact of inquiry based learning approach on critical thinking of EFL students. *EFL Journal*, 2 (2), 89-102.
- [13] Iakovos, T. (2011). Critical and creative thinking in the English Language classroom. *International Journal of Humanities, and Social Science*, 1 (8), 82-86
- [14] Jalmasco, N.M. (2014). Science Education Realities. *The Manila Times*. Available from: <http://www.manilatimes.net/science-education-realities/100096>
- [15] John Lawrence Tety (2016). Role of Instructional Materials in Academic Performance in Community Secondary Schools in Rombo District.
- [16] K to 12 Science Curriculum Guide (2013), Republic of the Philippines, Department of Education, DepEd Complex, Meralco Avenue, Pasig City.
- [17] Kearney, C. (2016) Effects to Increase Student's Interest in Pursuing Science, Technology, Engineering and Mathematics Studies and careers. Available from: <http://www.eun.org/publication/detailed?publicationID+983>
- [18] Leedy, P. & Ormrod, J. (2001). *Practical Research: Planning and design* (7th ed.). Upper Saddle River, NJ: Merrill Prentice Hall. Thousand Oaks: SAGE Publications.
- [19] Lumbang, B.C. (2020, January 4). *Instructional Materials in Teaching Science*. Pressreader.
- [20] Marbas, Jennifer(n.d.). The importance of Instructional Materials. *Academia*. Retrieved from: [www.academia.edu/8704377/The importance of Instructional Materials](http://www.academia.edu/8704377/The_importance_of_Instructional_Materials)
- [21] Mario James Simon De La Cruz (2017). Science ed and a thinking society. *Inquirer.net* Retrieved from: <https://opinion.inquirer.net/02324/sciebce-ed-thinking-society>
- [22] Naryanti (2017). Improving student's English writing skill through inquiry based learning.
- [23] National Human Genome Research Institute (2012). Understand your Role in Science Education. Retrieved from www.genome.gov
- [24] Organization for Economic Co-operation and Development (OECD)(2016). PISA 2015 Results (Volume 1): Excellence and Equity in Education. Retrieved from <http://dx.doi.org>
- [25] Padua, R.N. and Santos, R.G. (1997). *Educational Evaluation and Measurement: Theory, Practice, and Application*
- [26] Pedaste (2015) Phases of inquiry-based learning: Definitions and Inquiry Cycle
- [27] Schwab, Klaus (2018). The Global Competitiveness Report. *World Economic Forum*. Retrieved from: www.weforum.org/reports/the-global-competitiveness-report-2017-2018
- [28] Seels, B.B., & Richney, R.C. (1994). *Instructional technology: the definition and domains of the field*. Washington, DC: Association for Educational Communications and Technology
- [29] Tan-Espinar, M.J., and Ballado, R. S. (2017). Content Validity and acceptability of a developed worktext in Basic Mathematics 2. *Asia Pacific Journal Multidisciplinary Research*. 5 (11). 72-84
- [30] Thomas G. Ryan, Michael St-Laurent (2016) *Inquiry-based learning: Observations and Outcome*
- [31] Torrefranca, E. (2017). Development and validation of instructional modules on rational expressions and variations. *The normal Lights*, 11(1), 43-73. Retrieved from po.pnurseportal.org
- [32] Training Industry (2013). ADDIE Model. *Training Industry*. Retrieved from <https://trainingindustry.com>

- [33] Training Industry (n.d.). Instructional System Design (ISD). Training Industry. Retrieved from <https://trainingindustry.com>
- [34] Tumapon, T. (2020, February 27). Teaching science through visual aids. The Manila Times.
- [35] Wale and Bishaw (2020) Effects of Using Inquiry-based learning on EFL students critical thinking

Electrical Sources

- [36] Inan, C., & Erkus, S. (2017). The effect of mathematical worksheets based on multiple intelligences theory on the academic achievement of the students in the 4th grade primary school. ResearchGate.
https://www.researchgate.net/publication/319565505_The_Effect_of_Mathematical_Worksheet
- [37] Philmckinney (2017). Innovation in the Classroom: Why Education Needs to be More Innovative. Retrieved from: Philmckinney.com
- [38] Works and Days (2021). Learning Activity. Retrieved November 5, 2021, from <https://newlearningonline.com/learningdesign/glossary/learning-activity>



UIJRT

ISSN: 2582-6832