Vol. 40 · March 2020
DOI: https://doi.org/10.7719/jpair.v40i1.778

Print ISSN 2012-3981
Online ISSN 2244-0445

Glocalized Experiential Learning Infused Resource Package in Earth and Life Science

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Originality: 100% • Grammar Check: 100% • Plagiarism: 0%

ABSTRACT

The study aimed towards the development and evaluation of glocalized experiential learning-infused resource package in Earth and Life Science. The study used the educational design research method and involved the generation of a learning resource package. Participants of the study include the Grade 11 students of LNFVHS, S.Y. 2019-2020, as well as learning experts. Both qualitative and quantitative data were gathered for the study. Qualitative data came from focus group discussions, while quantitative data came from the results of the Bioenergetics test and Learning Material Evaluation Form. The least mastered competencies generated were The Cell, Photosynthetic Reactions, and Acquisition and Utilization of Energy. From this result, a glocalized experiential learning infused resource package was developed consisting of three learning materials based on the least mastered concepts--two (2) print materials (Learner's Material and Teacher's Guide) and one (1) non-print (Video-Based Module). The resource package was rated as very acceptable (3.70 for Learner's Material, 3.65 for Teacher's Guide, and 3.62 for the Video-Based Module). The study revealed that when learning materials were glocalized, contextualized, and infused with

experiential learning activities, learners were more likely to be engaged in learning the concepts. The learning package developed helped in encouraging independent learning and a good source of supplemental learning material for Grade 11 and other grade levels.

Keywords **—** Education, glocalization, learner's material, teacher's guide, video-based module, science performance, experiential learning, resource package, bioenergetics

INTRODUCTION

Glocalized experiential learning materials in the K to 12 Program is very scant. Although the program attempts to create an impeccable activity-based curriculum, it still needs the help of glocalized activity-based learning materials. The Department of Education's Learning Resource Management and Development System (LRMDS) portal does not have any learning materials for Earth and Life Science. The use of glocalized experiential learning in teaching science subjects is proven to improve critical thinking skills and independent learning leading to the attainment of competencies in the said subject.

Earth and Life Science are one of the core subject's mandatory for all the tracks in the K to 12 program. Earth and Life Science is a compulsory subject in the National Curriculum. Being the center of the said curriculum, it is necessary to provide enough support in improving the teaching-learning processes of the students for them to be ready in their chosen career.

The Philippines ranked in the low 70s in the 2018 Programme for International Student Assessment (PISA), a student assessment of 15-year-old learners across 79 countries done by the Organization for Economic Co-operation and Development (OECD). In the said assessment, the Philippines ranks last among 79 countries in reading comprehension and also ends up in the low 70s in mathematics and science (Trinidad, 2020). The National Achievement Test (NAT) results of the students in Libacao National Forestry Vocational High School, as well as in the Division of Aklan, revealed that the Science and Math scores are the lowest among the subjects being assessed (Department of Education, Division of Aklan, 2018). Science is a subject that is best learned through hands-on and actual experience. It has been observed that students lack this aspect of learning. The module created by the researcher is rooted in Experiential Learning Theory. This theory emphasized that through experiences, in various forms, the student can best understand and retain the topics being discussed.

Republic Act No. 10533, made into law last May 15, 2013, mandates the DepEd to develop an enhanced basic education curriculum that is both contextualized and global (Official Gazzette, 2013).

Glocalization is the simultaneous occurrence of both universalizing and particularizing tendencies in contemporary social, political, and economic systems. The term is a linguistic hybrid of globalization and localization (Robertson, 2013). The learning module that this study produced follows this same principle, which is creating a learning material in Earth and Life Science contextualized to the local Senior High School learners in the Philippines, and which can also be tailored to global learners as a whole.

Anchored to Experiential Learning Theory (ELT), most of the activity-based instructions in the validated module tried to accommodate differentiated learning Strategies of every learner. The activities encourage the learner to explore his surroundings and relate it to the targeted topics of the subject. The learning package would pave the way towards innovative success in the educational advancement of the K to 12 Program. Hence, this study focused on the development of glocalized experiential learning infused learning resource package in Earth and Life Science to enhance the experiential learning of the students and, thus, enhance their mastery of the skills on the targeted competencies. This research would serve as a first step in encouraging the development of other ELT-infused modules not just in Earth and Life Science but also in other subjects.

FRAMEWORK

This study was anchored on the Experiential Learning Theory (ELT). ELT provides a holistic model of the learning process and a multilinear model of adult development, both of which are consistent with what we know about how people learn, grow, and develop. The theory is called "Experiential learning" to emphasize the central role that experience plays in the learning process. Taking into consideration that the materials developed addressed the least-mastered concepts in Bioenergetics, the ADDIE model was used as a guide in the development process. The ADDIE model is the generic process traditionally used by instructional designers and training developers. The five phases—Analysis, Design, Development, Implementation, and Evaluation—represent a dynamic, flexible guideline for building effective training and performance support tools. The research followed this scheme.

Figure 1. Conceptual Framework of the study

Figure 1 shows the schematic flow of the variables of the study. The conceptual framework of the study was based on the ADDIE Model. The first box, assessment of the Grade 11 students' least-mastered skills in Bioenergetics, determined the concepts in Bioenergetics as the topics of the learning package developed. The next step, development of glocalized experiential learning infused resource package, included the design, implementation, and testing of the developed learning package. Finally, the polishing of the prototype modules leading to the final revised resource package in Earth and Life Science.

OBJECTIVES OF THE STUDY

Generally, this study was conducted to develop a glocalized experiential learning-infused resource package in Earth and Life Science (Bioenergetics) for Grade 11. Specifically, the researcher sought to answer the following research questions: (1) what are the least-mastered competencies of students in Earth and Life Science? (2) What can a resource package be developed to address the needs of the students in enhancing their learning experiences? (3) How acceptable is the developed print resource package such as Learners' Material and Teacher's Guide as evaluated by the Senior High School students and Learning Experts in terms of (a) physical aspects; (b) learning outcomes; (c) earth and life science content and processes; (d) experiential learning activities; (e) evaluation procedure; and (f) relevance of the learning material in enhancing the experiential learning level of students? (4) How acceptable is the developed non-print resource package as evaluated by the Senior High School students and Learning Experts in terms of (a) content quality, (b) instructional quality, and (c) technical quality?

METHODOLOGY

Research Design

The study employed the educational design research method and involved the generation of a learning resource package in Earth and Life Sciences. Both quantitative interpretation of data and thematic analysis of qualitative data were used as the basis for the development of the resource package. Educational design research is defined as the systematic analysis, design, and evaluation of educational interventions with the dual aim of generating research-based solutions for complex problems in educational practice and advancing knowledge about the characteristics of these interventions and the processes of designing and developing them (Plomp, 2013). The ADDIE Model of phases of curriculum designing was utilized in the development of the learning resource package. The major phases were the following: (a) Analysis phase, (b) Design phase, c) Development phase, (d) Implementation phase, and (e) Evaluation Phase.

Research Site

The study was conducted in Libacao National Forestry Vocational High School (LNFVHS), Poblacion, Libacao, Aklan. The assessment of least-mastered concepts, the FGD Protocol for the learning experts and students, as well as the evaluation of the learning resources was conducted in the same school. Pilot testing of the modules was also conducted at LNFVHS, Poblacion, Libacao, Aklan.

Figure 2. Map of Aklan Province (Left) and Map of Poblacion, Libacao (Right)

Participants

The participants of this study included the thirty (30) Grade 11 students of the Libacao National Forestry Vocational High School, inclusive of all tracks and strand offerings in the Senior High School Curriculum, enrolled in the current school year 2019-2020, as well as thirty (30) learning experts (science teachers, LRMDS Coordinators, textbook writers, and ICT Experts).

Thirty (30) Grade 11 students were the respondents in assessing the least-mastered competencies. Ten (10) students from the thirty (30) respondents were chosen as key informants using criterion sampling to join the Focused Group Discussion (FGD) during the Evaluation Phase. They were able to meet these criteria: a.) the student is verbose; b.) and able to share his/her experience regarding the topics very well. All respondents were the ones who evaluated the Learner's Material and the Video-Based Module.

Thirty (30) experts evaluated the Teacher's Guide. Ten (10) of the learning experts were chosen using purposive sampling to join the Focused Group Discussion (FGD) during the Implementation and Evaluation Phases of the study. The experts were composed of textbook writers, science teachers, LRMDS Coordinators, and ICT experts. The same FGD key informants evaluated the Video-Based Module and the Learner's Material.

Instrumentation

There were five (5) data gathering instruments used in this study: (a) the researcher-made test, (b) FGD Protocol for Learning Experts, (c) FGD Protocol for Students, (d) Learning Material Evaluation Form (LMEF) for Print Materials, and (e) Learning Material Evaluation Form (LMEF) for Non-Print Material.

a. The researcher-made test. The researcher-made test was used during the Analysis Phase to determine the students' least-mastered skills in Bioenergetics. There were five competencies where the 50-item multiple-choice test was generated from: (1) explain how cells carry out functions required for life (cellular structure and function); (2) explain how photosynthetic organisms use light energy to combine carbon dioxide and water to form energy-rich compounds (photosynthetic reactions); (3) trace the energy flow from the environment to the cells (energy flow); (4) describe how organisms obtain and utilize energy (acquisition and utilization of energy); and, (5) recognize that organisms require energy to carry out functions required for life (life processes). The results of the test revealed the competencies to be used in the creation of the proposed

learning package. Initially, there were 60 items of multiple-choice questions created using a Table of Specifications (TOS) (Appendix B): twelve (12) items per competency. The KR-20 was the reliability test used in identifying the final TOS and the 50 questions. After validation and reliability testing, a total of 50 item test questions were created from the original test. This number was equally divided among the five learning competencies under Bioenergetics.

Validity. The instrument used in this research underwent content validation by a jury composed of five (5) members who were selected based on their expertise in research and test construction to ensure the validity of the test questions, FGD protocols, and evaluation forms. The jury was requested by the researcher to evaluate the format, wording, and content of the instruments. The researcher made sure that the suggestions, comments, and recommendations made by the jury were considered in the revision of the questionnaire to guarantee the suitability of the questions for data collection.

Reliability. After validating the contents of the instrument, a reliability test was done. For the researcher-made test for least-mastered Bioenergetics competency, a dry run was conducted to one section of the Grade 11 students. The results of the test underwent item analysis, and from the original 60-item multiple-choice questions, it went down to an improved 50-item test. KR20 was used and yielded to an r-value of 0.768.

b. The Learning Material Evaluation Form (LMEF) for Print Modules.

The Learning Material Evaluation Form (LMEF) for Print Modules was used to assess the acceptability level of the print materials. This was adapted from Navejas' (2017) dissertation Integration of Pedagogical Content Knowledge (PCK) in the Learning Module on Mathematics in the Modern World. The Teacher's Guide was evaluated by the learning experts while the Learner's Material was evaluated by both the students and the learning experts. The LMEF evaluated the following aspects of a good learning resource material: (a)physical aspects,(b) learning outcomes, (c) earth and life science content and processes, (d) instructional design, (e) learning activities, (f) evaluation procedure, and, (g) relevance of the learning material in enhancing the experiential learning level of students.

c. Learning Material Evaluation Form (LMEF) for Non-Print Modules.

The Learning Material Evaluation Form (LMEF) for Non-Print Modules was used to evaluate the video-based module. This was adapted from

the Department of Education's Learning Resource Management and Development System (DepEd LRMDS) Quality Assurance Form for Non-Print Materials. Although there were three (3) video-based modules created, they were evaluated as one entity. The respondents were both the students and the learning experts. It evaluated the following criteria of a good learning resource material: (a) content quality, (b) instructional quality, and (c) technical quality.

d. Focused Group Discussion (FGD) Protocol for experts. The FGD Protocol for experts was divided into three parts: (1) Introduction, (2) Preliminary Questions, and (3) Learning Material Specific Questions. This was used during the Evaluation Phase of the study. This was administered to the learning experts.

e. Focused Group Discussion (FGD) Protocol for students. The FGD Protocol was divided into three parts: (1) Introduction, (2) Preliminary Questions, and (3) Learning Material Specific Questions. This was used during the Evaluation Phase of the study. This was administered to the students.

Research Ethics Protocol

A letter of consent and a waiver were given to the participants to read and sign, stating that all data will remain confidential and that it was purely voluntary and that they may withdraw their participation anytime without penalty. Utmost confidentiality of their identity and the data gathered were given importance. The reporting of findings was done as a result of groups and not the results of individuals. The FGD Key Informants were also informed that their real names were replaced with aliases. For student participants below the legal age, a parent's consent was given for their parents to sign. Proper citations were made for references and tools lifted from literature and other researches.

Data Collection

At the onset of the study, a letter of request was sent to the Schools Division Superintendent of DepEd, Division of Aklan, to lay down the purpose of the study. All participants were oriented as to the rationale of the study. Consent and waivers were required by the respondents. The conduct of the study commenced a week after the letter of approval from the granting agency.

A researcher-made test on the concepts under Bioenergetics was administered to the students to determine which competency should be used in developing

the learning package. Once the least-mastered competencies were identified, designing and development of the print and non-print learning materials started.

After the learning materials were created, pilot implementation of the learning package was conducted to one section of the Grade 11 students. The students were given the Learner's Material a week prior to the conduct of the actual lecture for them to read in advance. The experts were given both the Learner's Material and Teacher's Guide prior to the lecture-discussion. Ten (10) learning experts oversaw the conduct of the Learner's Material and Video-Based Module.

To evaluate the Teacher's Guide, one (1) teacher, handling Earth and Life Sciences subject, was asked to conduct the learning package to another section. The demonstration teacher has also seen the conduct of the learning package by the researcher to the other section prior to the return-demonstration. Thirty (30) learning experts oversaw the conduct of the Teacher's Guide.

An initial evaluation of the resource package was conducted. Ten (10) randomly selected students and ten (10) learning experts were chosen to evaluate both the Learner's Material and Video-Based Module. Ten (10) learning experts evaluated the Teacher's Guide.

After the Learning Material Evaluation Form (LMEF) were collected, all information (both qualitative and quantitative) were encoded, tabulated, and interpreted. After determining the results of the evaluation, Focused Group Discussion using the FGD Protocol was conducted to both students and experts who evaluated the Learning Package. There were two sessions: one for the experts and one for the students. The discussions served as the basis for the validation of the data they provided on the LMEF. The researcher used an audio-recorder to document the information shared by the key informants. After the interview, the notes were transcribed then translated from Akeanon (the mode of the language used by the informants) to English.

Revisions on the Learning Package were made based on the suggestions, recommendations, and comments of the evaluators and FGD informants.

The final evaluation of the resource package was then conducted using the same LMEF for print and non-print materials. Thirty (30) randomly selected students and ten (10) learning experts were chosen to evaluate both the Learner's Material and Video-Based Module. Thirty (30) learning experts evaluated the Teacher's Guide.

Using the ADDIE Model, the following activities took place in every step of the instructional design model.

Analysis Phase. This phase commenced with creating a researcher-made test with a table of specifications (TOS) to determine the least-mastered concepts in Bioenergetics. After finalizing the researcher-made test through validity and reliability testing, it was administered to one section of the Grade 11 students. The results are then encoded, tabulated, and expressed in mean raw scores per competency. The results with mean raw scores of 6.00 and below were determined as least-mastered competencies. Once the least-mastered competencies were identified, setting up of timeline for the duration of the rest of the phases of the ADDIE Model started.

Design Phase. The Design Phase started with research on the pedagogical considerations of the learning resource package. The result of the teacher-made test determined the competencies to be included in the learning resource package. Considerations on how the concepts of the learning resource package were placed in the materials were noted. Setting-up of the Learner's Material, Teacher's Guide, and Video-Based Module were also done taking note of its instructional, visual, auditory, and technical design. The sequencing of the contents of the print materials were also done in this phase. Scripts, storyboard, and content knowledge were drafted for both the print and non-print materials. Since the print materials mimic the DepEd's Guidelines, the features of good learning material were based on the mandatory features, as suggested by DepEd Division of Aklan Memorandum No. 411, s. 2018 (Aklan Literature and Arts Teachers Convention AklATCon 2018). The memorandum provides the guidelines of a standard module. The mandatory components of the non-print modules mentioned in the memorandum are as follows: title page, overview/ introduction, pre-assessment, general and specific objectives, curriculum guide reference code and duration, content, summary, external links (for enrichment), post-assessment, and references.

Additional guidelines recommended by the LRMDS regarding the content of the material suggests that the discussion should be in a conversational manner. The source materials should be rephrased without grossly changing information. The diagrams should be labeled. Important terms should be highlighted. Grammatical errors should be monitored and corrected. Pictures should be owned by the author or LRMDS bank or from the public domain but properly cited. Proper color coding for subjects must be observed by placing a box at the upper right corner, and the target grade level identifier. For science, the color code is orange.

For non-print modules, specifically for videos, the same memorandum provided guidelines. The videos must be educational in nature and must follow the Curriculum Guide on the chosen subject area and grade level. Content must be suitable for the target user's level of development. The videos must use original music, theme songs, and related songs or may utilize audios from the public domain. The films must be subtitled in grammatically correct English.

The learning resource package designed consisted of the print resource package. The print resource package includes the Learner's Material and the Teacher's Guide, while the non-print resource package includes the Video-Based Module.

Development Phase. During this phase, the assembly of the parts of the learning resource package were done. Video-recording, screen-casting, dubbing, and video-editing of the non-print material were executed in this phase. Glocalization in both the print and non-print materials is integrated through (1)the use of Mother Tongue language (Akeanon) in the video-based module; (2) using localized and indigenized materials in the experimentations and other experiential learning activities of both the Teacher's Guide and Learner's Material; and, (3) integrating a universal language (English) in both the print and non-print materials. The use of varied activities emphasizing the Experiential Learning, Multiple Intelligences, and Differentiated Strategies were seen in the elaboration and extension parts of the print materials. The use of mobile phones, the internet, and the camera in print materials, as well as the use of video in the non-print material, integrates ICT in the learning package. To assess student outcomes, pretests and posttests with answer keys were embedded in every chapter and a summative test at the end of the print materials. For ease in printing the pictures as visual aids during teaching, "Printables" were added at the end of every chapter of the Teacher's Guide. The cover and chapter design of non-print materials were originally designed and created by the researcher. Pictures and knowledge contents are taken from public domains were properly cited in the references. The print materials were printed back-to-back using A4 bond paper bounded on the left side with a staple wire. The video-based module is in mp4 format, created and edited using freeware: Ezvid for screen-casting and Movavi for editing.

Implementation Phase. During this phase, the conduct of the classes using the learning resource package was done. Prior to the pilot implementation of the developed module, the orientation of the participants was conducted in accordance with the ethical considerations of this study. The students were

provided with the Learner's Material one (1) week in advance for them to read and study during their vacant time. At the same time, the learning experts were given copies of both the Learner's Material and Teacher's Guide for them to pre-evaluate. After the researcher conducted a teaching demonstration to one (1) section of the Grade 11 students, a return-demonstration teacher conducted the learning resource package to another section. The research adviser and the learning experts oversaw the conduct of the classes by the researcher and the return-demonstration teacher.

Evaluation Phase. After the demonstration teaching of the researcher, the learning experts and students evaluated the Learner's Material and Video-Based Module using the Learning Material Evaluation Form (LMEF). After the teaching return-demonstration of the demonstration teacher, the experts evaluated the Teacher's Guide using the same LMEF. Thirty (30) students were chosen from the one (1) section to evaluate the Learner's Material and Video-Based Module. After analysis of the results of the evaluation, Focused Group Discussion (FGD) was conducted to each set of evaluators to confirm their evaluations and to solicit additional comments and suggestions. Based on the results of the FGD and LMEF, the learning resource package was revised accordingly. The final evaluation of the Learning Resource Package was then conducted to the revised materials.

To ascertain the validity of qualitative data, triangulation was conducted in this study. Creswell and Creswell (2017) defined triangulation as a procedure to seek convergence of data from multiple sources. These are usually done through member checking, thick description, peer reviews, and external audits. In this research, member checking was done by conducting Focus Group Discussions with participants after the pilot implementation of the learning materials. The external audit was done by having the qualitative data evaluated by science experts not involved in the study.

Figure 3 shows the summary of the activities in the five stages of the ADDIE Model used in this study.

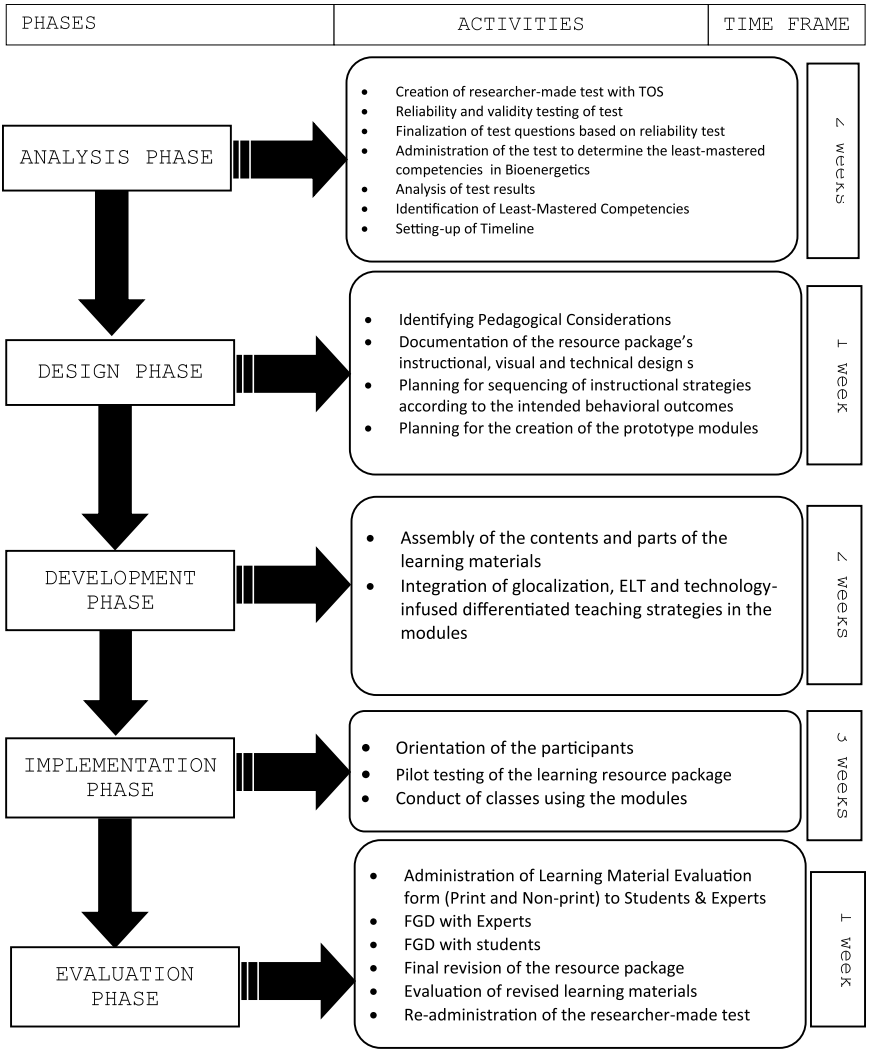


Figure 3. The Data Gathering Procedure

Statistical Techniques

The data collected were treated in two ways. Quantitative data was obtained from the results of the researcher-made test and the learning material evaluation form (LMEF). A Statistical Package for the Social Sciences (SPSS) version 2.0

software was used to compute the data. Descriptive statistics such as Mean and Standard Deviation were used. Thematic analysis of the result of the FGD protocols and the written comments and suggestions of the evaluators were used as the qualitative results for the validation of the learning resource. Finally, consolidation of interpretations of the results was used as a basis for the final revision of the learning resource package.

Raw scores in the test were totaled, tabulated, and expressed in Mean per intended competency or skill. Since there were 5 competencies and a total of 50-item test questions, there was a maximum raw score of ten (10) per competency. These were the interpretations for the test:

Mean Score	**Interpretation**
8.01-10.00	Highly Mastered
6.01-8.00	Satisfactorily Mastered
6.00 and below	Least Mastered

The researcher also utilized the Learning Material Evaluation Form (LMEF) to determine the acceptability level of the learning package. This was reported in mean for every criterion. A four-point Likert scale was used to measure their levels. Responses for each item of the questionnaire were given scores and interpretations as follows:

Descriptive Rating	Score	Range	Description	Interpretation
Excellent (E)	4	3.51-4.00	Very Acceptable	The learning material has excellently met the standards
Good (G)	3	2.51-3.50	Acceptable	The learning material has very satisfactorily met the standards
Fair (F)	2	1.51-2.50	Moderately Acceptable	The learning material has satisfactorily met the standards
Poor (P)	1	1.00-1.50	Barely Acceptable	The learning material has fairly met the standards

RESULTS AND DISCUSSION

Least Mastered Competencies in Bioenergetics

Out of the five (5) competencies, three (3) competencies were identified as *Least Mastered.* These competencies were: explain how cells carry out functions required for life (M=5.15, SD=2.41); explain how photosynthetic organisms use light energy to combine carbon dioxide and water to form energy-rich compounds (M=4.05, SD=1.76); and, describe how organisms obtain and utilize energy (M=4.20, SD=1.74). The other two (2) competencies, which were: trace the energy flow from the environment to the cells (M=7.15, SD=1.50), and recognize that organisms require energy to carry out functions required for life (M=7.00, SD=1.56), were interpreted as *Satisfactorily Mastered*.

Table 1. Least-mastered Competencies of Students in Bioenergetics

Topic	Competency (The students will be able to…)	Mean (n=20)	Standard Deviation	Interpretation
The Cell	…explain how cells carry out functions required for life	5.15	2.41	Least Mastered
Photosynthetic Reactions	…explain how photosynthetic organisms use light energy to combine carbon dioxide and water to form energy-rich compounds	4.05	1.76	Least Mastered
Energy Flow	…trace the energy flow from the environment to the cells	7.15	1.50	Satisfactorily Mastered
Acquisition & Utilization of Energy	…describe how organisms obtain and utilize energy	4.20	1.74	Least Mastered
Life Processes	…recognize that organisms require energy to carry out functions required for life	7.00	1.56	Satisfactorily Mastered

Legend: 8.01-10.00 (Highly Mastered); 6.01-8.00 (Satisfactorily Mastered); 6.00 and below (Least Mastered)

The result of the study partially conforms with that of Parker et al. (2012), indicating that the common misconceptions in bioenergetics were the competencies explain how photosynthetic organisms use light energy to combine carbon dioxide and water to form energy-rich compounds and describe how organisms obtain and utilize energy. In this study, the same competencies were

generated as the least mastered with the addition of the competency explain how cells carry out functions required for life. This implies that misconceptions in a certain topic often negatively affects the learner's mastery of the topic's competency.

During Focused Group Discussions among the students and experts, the following themes were generated as reasons why the three (3) concepts were least mastered: *Skipped Lessons, Teacher's Lack of Content Mastery, Unavailability of Instructional Materials, Insufficient Experiential Learning, Unstimulating Nature and Unfamiliar Terminologies.*

Skipped Lesson. During Focused Group Discussion, the students revealed that the identified least-mastered concepts in Bioenergetics were usually skipped during their classes in Junior High School. They were only given a summary of the concepts on the said topics.

Teacher's Lack of Content Mastery. During the FGD with the experts, one of the reasons why teachers skip topics or lessons in Science is primarily because of the teachers' lack of competence on the said topics themselves.

Unavailability of Instructional Materials. Another reason for the least-mastered competency, according to the experts, is the unavailability of instructional materials for hands-on activities. Both experts and students have only experienced a few of them in the form of textbooks and some traditional Manila paper as visual aids.

Insufficient Experiential Learning. Although experiential learning has been experienced by students and experts in forms of field trips; activities outside the classroom; integration of multiple intelligences in science such as role-play, dances and songs; and, laboratory experimentations; most informants claimed that there were less hands-on activities during the discussions of topics in bioenergetics. Experts believe that additional instructional materials should be integrated when discussing science concepts. They also added that hands-on activities were affected by the lack of available equipment and instructional materials.

Unstimulating Nature and Unfamiliar Terminologies. Another reason why the three competencies (The Cell, Photosynthesis, and Cellular Respiration) were generated as the least-mastered competencies is because of the nature and level of difficulty of the concepts themselves. The concepts, according to the students and most experts, are boring and contains a lot of incomprehensible terminologies. In general, most students and experts agree that the three least-mastered competencies have concepts with unfamiliar terminologies and uncommon formulas. The experts believe that appropriate modifications to their strategies should be made to make sure understanding of these concepts.

The Glocalized Experiential Learning Infused Resource Package

There were three (3) learning materials developed after the identification of the least-mastered competencies in Bioenergetics. There were two (2) print materials, namely, the Teacher's Guide and the Learner's Material. The non-print material was the Video-Based Module. The learning materials have the same content knowledge based on the results of the researcher-made test. The topics in the Learning Package are (1) The Cell, (2) Photosynthetic Reactions, and (3) Acquisition and Utilization of Energy. Glocalization and Experiential Learning Theory were the focus in designing and developing the said glocalized experiential learning-infused resource package in Earth and Life Science.

The assembly of parts of the learning resource package, typing, lay outing, cover and chapter designing, binding, video recording, screen-casting, dubbing, and video editing were executed by the researcher. Glocalization in both the print and non-print materials is integrated through (1) the use of Mother Tongue language (Akeanon) in the video-based module; (2) using localized and indigenized materials in the experimentations and other experiential learning activities of both the Teacher's Guide and Learner's Material; and, (3) integrating a universal language (English) in both the print and non-print materials. The use of varied activities emphasizing experiential learning, multiple intelligences, and differentiated strategies were seen in the elaboration and extension parts of the print materials. The use of mobile phones, the internet, and the camera in the print material, as well as the use of video in the non-print material, integrates ICT in the learning package. To assess student outcomes, pretests and posttests with answer keys were embedded in every chapter and a summative test at the end of the print materials. For ease in printing the pictures as visual aids during teaching, "Printables" were added at the end of every chapter of the Teacher's Guide. The cover and chapter design of non-print materials were originally designed and created by the researcher. Pictures and knowledge contents are taken from public domains were properly cited in the references.

Revisions of the Learning Resource Package for Bioenergetics were based on the results of initial evaluations as well as the qualitative findings from focused group discussions. Aside from technicalities and a few contextual errors, only additional page components were added to the nonprint materials. There was a major revamp on the musicality of the Video-Based Module to meet the demands as suggested during the FGD.

a. *Learner's Material*

The Learner's Material was printed back-to-back using A4 bond paper bounded on the left side with a staple wire. A spine containing the title and the type of learning material hides the binding. The text font is Times New Roman, size 12, and line spacing at 2pt. Learner's Material was written in a conversational manner. It has a total of 42 pages.

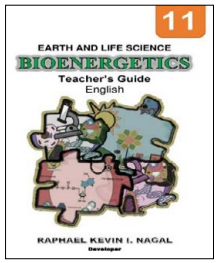
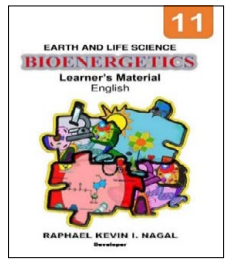
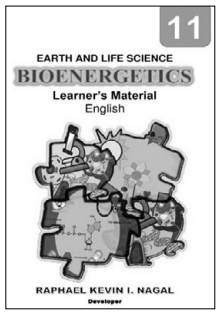
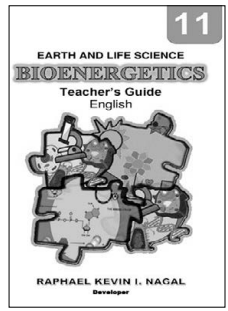
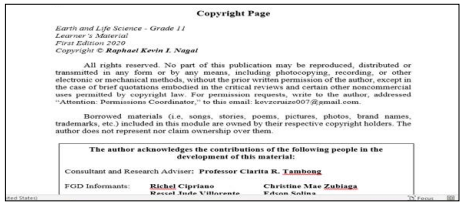
b. *Teacher's Guide*

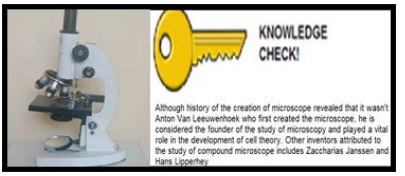
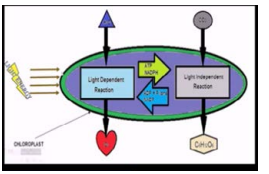
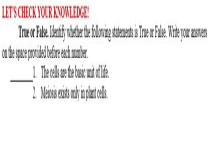
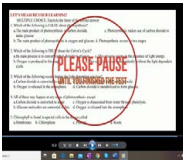
The Teacher's Guide was printed back-to-back using A4 bond paper bounded on the left side with a staple wire. A spine containing the title and the type of learning material hides the binding. The text font is Times New Roman, size 12, and line spacing at 2pt. The Teacher's Guide was written similarly to a detailed lesson plan. The design mimics that of the Learner's Material but with a few differences, including the font colors of the cover and chapter pages. There was no separate page for the answer key as the answers were already written at the bottom of every test and activities. The initially developed Teacher's Guide was modified and added with other pages based on the suggestions during the Focused Group Discussions and during the preoral defense. It has a total of 58 pages.

c. *Video-Based Module*

The video-based module is in mp4 format, created and edited using freeware: Ezvid for screen-casting and Movavi for editing. The script of this nonprint material was written in a conversational manner. This was intended to supplement the Learner's Material during the lesson for further retention. The content of the video-based module is similar to the content of the Learner's Material and Teacher's Guide except that the concepts are in audio-video format. Changes in its technical quality were applied based on the suggestions from the FGD.

Table 2. Major Features of the Learning Resource Package

Features	Learner's Material	Teacher's Guide	Video-Based Module
Cover Page			
About the Developer's Page / Introductory Video			
Title Page / Graphic Introduction			
Copyright Page			

Features	Learner's Material	Teacher's Guide	Video-Based Module
Knowledge Checker / Graphic Illustrations			
Assessment			

The features of a good learning material used in this study were based on the mandatory features, as suggested by DepEd Division of Aklan Memorandum No. 411, s. 2018 (Aklan Literature and Arts Teachers Convention AklATCon 2018). The memorandum provides the guidelines of a standard module. The mandatory components of the nonprint modules mentioned in the memorandum are as follows: title page, overview/introduction, pre-assessment, general and specific objectives, curriculum guide reference code and duration, content, summary, external links (for enrichment), post-assessment, and references.

The San Diego Community College District (2015) also released the basic components of a good module. According to their guidelines, "…this type of customization creates a learning path that meets the needs of individual learners." Each module consists of 7 components. These are (1) Pre-Assessment; (2) Learning Objectives; (3) Assigned Reading; (4) Assigned Writing; (5) Exercise/ Activities; (6) For Further Study; and, (7) Assessment.

Additional guidelines recommended by the LRMDS regarding the content of the material suggests that the discussion should be in a conversational manner. The source materials should be rephrased without grossly changing information. The diagrams should be labeled. Important terms should be highlighted. Grammatical errors should be monitored and corrected. Pictures should be owned by the author or LRMDS bank or from the public domain but properly cited. Proper color coding for subjects must be observed by placing a box at the upper right corner, and the target grade level identifier. For science, the color code is orange.

For non-print modules, specifically for videos, the same memorandum provided guidelines. The videos must be educational in nature and follow the Curriculum Guide on the chosen subject area and grade level. Content must be suitable for the target user's level. The videos must use original music, theme songs, and related songs or may utilize audios from the public domain. The films must be subtitled in grammatically correct English.

According to Cerezo Merchán et al. (2017), some guidelines must be followed in creating a video. This study suggested considering the needs of people with sensory disabilities during the processes of audiovisual pre-production, production, and post-production to improve the level of accessibility of audiovisual works. The average attention span continues to shrink, so the shorter the video, the better. A quality microphone is needed, and it should be recorded in high-resolution 720p or HD, which has a resolution of 1280x720. A widescreen 16:9 ratio must be used. Giving audience click-to-play control over the videos is the polite thing to do.

The aforementioned guidelines were taken into consideration in creating the print and non-print learning materials in this study.

Acceptability of the Print Resource Package

The print resource package includes the Learner's Material and the Teacher's Guide.

a. Learner's Material

Tables 2 summarizes the acceptability of the Learner's Material in terms of physical aspects, learning outcomes, earth and life science content and processes, experiential learning activities, evaluation procedure, and relevance of the material to experiential learning. The Learner's Material was evaluated by thirty (30) students and ten (10) learning experts. The total weighted mean of the Learner's Material in all criteria was rated at 3.70(SD=0.054), which is Very Acceptable. As interpreted, the value means that the learning material has excellently met the standards.

Table 3. Over-all Summary of Acceptability of the Developed Learner's Material

Criteria	Weighted Mean	SD	Description	Interpretation
Physical Aspects	3.80	0.162	Very Acceptable	The learning material has excellently met the standards
Learning Outcomes	3.66	0.163	Very Acceptable	The learning material has excellently met the standards
Earth and Life Science Content and Processes	3.69	0.182	Very Acceptable	The learning material has excellently met the standards
Experiential Learning Activities	3.68	0.153	Very Acceptable	The learning material has excellently met the standards
Evaluation Procedure	3.66	0.198	Very Acceptable	The learning material has excellently met the standards
Relevance of the Material to Experiential Learning	3.73	0.090	Very Acceptable	The learning material has excellently met the standards
Total Weighted Mean:	3.70	0.054	Very Acceptable	The learning material has excellently met the standards

Legend: 3.51-4.00 (Very Acceptable); 2.51-3.50 (Acceptable);
1.51-2.50 (Moderately Acceptable) 1.00-1.50 (Barely Acceptable)

During Focused Group Discussions among the students and experts, the following were the common themes generated for the qualitative aspects of the Learner's Material: *Physical Properties; Design and Layout; Assessment Formatting;* and*, Learning Activities*.

Physical Properties. A student and an expert mentioned that the cover should be more durable than its current state and should be changed to at least a board paper.

Design and Layout. This aspect has the biggest bulk of comments and suggestions from the students and experts. Most of the comments are on the formatting of texts and pictures. Some students commented about the font layout and design. Areas for improvement for the pictures, diagrams, and illustrations were also noted by the experts. Other experts also noted some layout errors in the Learner's Material and provided some recommendations.

Assessment Formatting. This theme is focused on the informants' comments and suggestions about the formulation of questions in the assessment part of the Learner's Material. The comments were mostly on the Posttests. One student also

noted the conceptual error in one of the posttests. One of the experts in the FGD was able to attend a seminar about the formulation of multiple-choice questions.

Learning Activities. This theme refers to the comments and suggestions of the informants regarding the embedded various learning activities of the Learner's Material. Most comments are positive. Another student commented about the stand-alone quality of the Learner's Material and its ability to promote independent learning.

b. Teacher's Guide

Table 3 summarizes the acceptability of the Teacher's Guide in terms of physical aspects, learning outcomes, earth and life science content and processes, experiential learning activities, evaluation procedure, and relevance of the material to experiential learning. The Teacher's Guide was evaluated by thirty (30) learning experts. The total weighted mean of the Teacher's Guide in all criteria was rated at 3.65 (SD=0.079), which is Very Acceptable. As interpreted, the value means that the learning material has excellently met the standards.

Table 4. Over-all Summary of Acceptability of the Developed Teacher's Guide

Criteria	Weighted Mean (N=30)	SD	Description	Interpretation
Physical Aspects	3.70	0.179	Very Acceptable	The learning material has excellently met the standards
Learning Outcomes	3.76	0.152	Very Acceptable	The learning material has excellently met the standards
Earth and Life Science Content and Processes	3.68	0.172	Very Acceptable	The learning material has excellently met the standards
Experiential Learning Activities	3.55	0.051	Very Acceptable	The learning material has excellently met the standards
Evaluation Procedure	3.58	0.088	Very Acceptable	The learning material has excellently met the standards
Relevance of the Material to Experiential Learning	3.61	0.153	Very Acceptable	The learning material has excellently met the standards
Total Weighted Mean:	3.65	0.079	Very Acceptable	The learning material has excellently met the standards

Legend: 3.51-4.00 (Very Acceptable) 2.51-3.50 (Acceptable)
1.51-2.50 (Moderately Acceptable) 1.00-1.50 (Barely Acceptable)

During Focused Group Discussions among the experts, the following were the common themes generated for the qualitative aspects of the Teacher's Guide: *Similarity to Comments for the Learner's Material*; *Additional Layout and Design Suggestions*; and, *Comprehensiveness of the Teacher's Guide*.

Similarity to Comments for the Learner's Material. All comments for the Teacher's Guide came from the experts only. The experts mentioned the same suggestions they had for the Learner's material in terms of Physical Properties, Design and Layout, and Assessment Formatting.

Additional Layout and Design Suggestions. On top of the comments and suggestions for layout and design of the Learner's Material, additional comments were noted by the experts. One of the experts mentioned that there should be a modification of the design of the Teacher's Guide from the Learner's Material. An ICT expert also suggested removing the "glow" effects of the Chapter Title Pages.

Comprehensiveness of the Teacher's Guide. The learning experts noted the completeness of the Teacher's Guide in the teaching-learning process. Experts said that the TG is more detailed. The information is not overloaded but still complete.

The acceptability levels of the print resource package conform with Tan-Espinar and Ballado's (2017) research that the learning package were rated very high by both teachers and students even though there were some areas for improvement. This confirms that despite how impeccable an instructional material looks like, there are always suggestions on how it should be finalized. Revision is a necessary part of the entire process of product development. Instructional materials provide ideas and practices which frame classroom activities to be as smooth as possible. Thus, validation among experts and users is essential.

Acceptability of the Non-Print Resource Package

The non-print resource package generated from this study is the Video-Based Module. Table 4 summarizes the acceptability of the Video-Based Module in terms of content quality, instructional quality, and technical quality. The Video-Based Module was evaluated by thirty (30) students and ten (10) learning experts. The total weighted mean of the Video-Based Module in all criteria was rated at 3.62 (SD=0.143), which is Very Acceptable. As interpreted, the value means that the learning material has excellently met the standards.

Table5. Over-all Summary of Acceptability of the Developed Video-Based Module

Criteria	Weighted Mean (N=30)	SD	Description	Interpretation
Content Quality	3.76	0.152	Very Acceptable	The learning material has excellently met the standards
Instructional Quality	3.62	0.148	Very Acceptable	The learning material has excellently met the standards
Technical Quality	3.48	0.152	Acceptable	The learning material has very satisfactorily met the standards
Total Weighted Mean:	3.62	0.143	Very Acceptable	The learning material has excellently met the standards

Legend: 3.51-4.00 (Very Acceptable) 2.51-3.50 (Acceptable)
1.51-2.50 (Moderately Acceptable) 1.00-1.50(Barely Acceptable)

During Focused Group Discussions among the experts, the following were the common themes generated for the qualitative aspects of the Video-Based Module: *Audio Quality, Video Quality*, and *Video-Based Module as Supplemental and Independent Learning Material*.

Audio Quality. The audio quality of the Video-Based Module was rated as the lowest criterion in the Acceptability Survey for non-print materials. Both the students and the experts agreed that improvements should be done on the narration and the musicality of the material. For the background music sans narration, both sets of informants agreed that instrumental music should be used as background. Based on these comments, an expert provided suggestions as to where to download good audio materials.

Video Quality. The animations, illustrations, and other properties of the videos were commented by the informants. Experts suggested that the animations and illustrations should be in synchrony with the narratives. For better video editing experience, one informant suggested a freeware. Aside from the Windows Moviemaker and EzVid, the expert suggested Movavi.

Video-Based Module as Supplemental and Independent Learning Material. Both sets of informants agreed that the Video-Based Module is good complementary learning material for the Teacher's Guide and Learner's Material. The material is also a stand-alone that a student can learn independently using only the video. To further strengthen the Video-Based Module's ability to enhance the learning

of concepts and mastery of competencies, informants suggested adding captions or subtitles so that students can follow through the narration.

The acceptability level of the non-print resource package agrees with the study conducted by Chong et al. (2005). This study revealed that despite the fact that the video-based module produced conformed to the requirements of students in terms of contents, instructional, and technical quality, it is believed that it still has some room for improvement, especially on the audio and video quality. This also concurs with the study of Larawan (2013) as the developed non-print resource package is an effective and flexible instructional material that helps students learn the lessons seamlessly.

CONCLUSIONS

The study aimed towards the development and evaluation of glocalized experiential learning-infused resource package in Earth and Life Science. Experiential learning is theorized to improve students' mastery of the competencies in Earth and Life Sciences, specifically the concepts in Bioenergetics. Based on the findings of the study, the following conclusions were drawn.

Most students in Grade 11 of Libacao National Forestry Vocational High School have difficulties in three (3) out of the five (5) competencies in Bioenergetics. These competencies were: explain how cells carry out functions required for life; explain how photosynthetic organisms use light energy to combine carbon dioxide and water to form energy-rich compounds; and describe how organisms obtain and utilize energy.

The difficulties were mainly due to both teacher and learner factors. These include the fact that the identified least mastered concepts were oftentimes skipped by teachers during their elementary and junior high school years. The teachers' reasons for skipping the lessons include low mastery of the concepts and misalignment of teaching loads to non-science major teachers. Other reasons for the low mastery levels of students include unavailability of instructional materials for the said concepts, insufficient experiential learning activities, the boring nature of the topics, and the unfamiliar terminologies associated with the concepts.

When learning materials are glocalized, contextualized, and infused with experiential learning activities, learners are more likely to be engaged in learning the concepts. Furthermore, conversational manner of teaching, as well as the use of varied learning materials to supplement traditional teaching methods, are proven to enhance understanding of the topics. Teachers aided with the

Teacher's Guide find it easier to impart knowledge and master the competencies themselves. Lastly, Video-Based Modules are the best response to address the needs of 21st century-learners who are more visual when it comes to learning. The learning package helps in encouraging independent learning and also a good source of supplemental learning material not just for Grade 11 but also for other grade levels.

The overall rating of both the print and non-print resource package were very high or very acceptable to both the experts and the users. With the Resource Package's handiness, engaging designs, ease of comprehension, learning activities that are simple and easy to follow, and the fact that the package is both stand-alone and complementary would likely improve the participant's experiential learning and thus, enhance their mastery of the competencies under Bioenergetics. Therefore, developing a glocalized experiential learning-infused resource package in Earth and Life Science with the aforementioned features could significantly improve the students' performance in Bioenergetics.

TRANSLATIONAL RESEARCH

The study was able to create three instructional materials in Science, namely Learner's Material, Teacher's Guide, and the Video-Based Module. These products will pave the way towards the development of other resource packages not just in Science but also in other subjects. The materials are undergoing a copyright process at the National Library to be followed by its mass production and distribution among HEIs and BEIs. Aside from hard copies, digital copies are also being reproduced.

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