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Evaluation of Earth and Life Science Module for Senior High School in State University

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ABSTRACT:- Science education in the 21st century confronts a number of challenges, as identified by the National Center for Education Statistics (2007). The availability of suitable textbooks and classroom resources, as well as the preparation and training of teachers in science are all essential factors. This study is therefore aimed at evaluating a comprehensive learning module that supports students' understanding of concepts in Earth and Life Science for Senior High School. The study was conducted at President Ramon Magsaysay State University, having twenty respondents selected through purposive-convenience sampling technique. To assess the validity of the developed learning module, the researchers adopted an assessment tool. The evaluation results reveal a substantial agreement among respondents regarding the content, instructional design and technical aspects of the module. Furthermore, there were no significant variations in the evaluation of the module's applicability to different respondent profiles, emphasizing its potential as a valuable resource. It can effectively aid high school students in comprehending Earth and Life Sciences concepts. However, further revisions and improvement should be done to meet the specific needs of science educators and students.

Keywords: content, instructional design, instructional material assessment, instructional material, learning module, technical design,

I. INTRODUCTION

According to the Philippine Education Research Journal (2016), the K to 12 Program, designed to ensure the comprehensive development of every graduate, encompasses Kindergarten and 12 years of basic education. Its primary aim is to allocate ample time for students to acquire and master essential concepts and skills. The K to 12 Program promotes lifelong learning, equipping graduates with the knowledge and skills necessary for higher education, mid-level skill development, employment opportunities, and entrepreneurship. By catering to every child's fundamental learning needs, the program helps graduates develop a deep understanding of the world around them, fostering a passion for continuous learning. This approach lays the foundation for personal growth and success, creating a well-rounded and adaptable workforce.

The National Research Council (2007) points out that there are four components of science education. The conceptual aspect helps students grasp scientific knowledge and ideas; the cognitive aspect focuses on boosting students' critical thinking skills in a scientific context; "ideas-about science component that helps students understand how scientific knowledge is gained, along with the processes, values, and implications that come with it; and the social and affective aspect that helps students work together effectively and create exciting learning experience.

Gluckman (2011) argues that the goal of science education is to learn how to operate with scientific concepts, but developments in learning theory suggest that worthwhile science learning requires attention to the values, aesthetics, feelings and personal narratives which people use to make meaning. Certainly learning concepts is important, but for this to happen a good deal of 'translation' needs to occur, and this is best achieved through activities and tasks which help students make explicit the relationships between science concepts and stories or contexts into which they can talk their knowledge.

According to Mehisto (2012), learner's materials are the resources that contain knowledge and information represented in variety of formats which can be used by teachers to support the achievement of intended learning outcome. It can help students in understanding concepts which can be measured using end of module test or unit test (Rahman, 2015).

Science education, as it is today, often does not create atmospheres that enable children to comprehend scientific knowledge. Instead, it leans more towards methods including experimental work at the expense of

science as a process of building theories and models which are seen as internally consistent and coherent then tested empirically. This lack of focus on theory, explanation, and models may hinder children's comprehension of the development of scientific knowledge. Rather, it may even reinforce misconceptions like scientific knowledge being easy to obtain through direct observations alone. Nevertheless, there might be also some contributions by curricula; teachers' understanding about science as a way to know may be limited too (Abd-El-Khalick, F. et al., 2000).

The three elements that affect teaching and learning are curriculum, pedagogy and assessment. These three elements must be interwoven in order to offer students a transformational educational experience. It is opposed to the standard means of delivering education globally (Osborne, 2007). Learning materials play a crucial role in supporting student learning and significantly contribute to their academic success. Regardless of the type or format, learning materials serve various functions that enhance students' understanding and mastery of concepts (Ministry of Education, 2017). The selection of appropriate learning materials is important when attempting to teach effectively. Thus, it is important to choose items that are consistent with the needs of students and appropriate for the teaching and learning condition. This will ensure that learners are supported enough to understand and meet their academic goals (National Academy of Sciences, 2018). According to Torrefranca (2017), modular instruction is an attempt to personalize learning by allowing students to achieve mastery of the lesson.

CONCEPTUAL FRAMEWORK

The evaluation process of the learning material for Earth and Life Science in Senior High School is depicted in Figure 1. The first box outlines the profile of the respondents, providing information about the participants involved in the study. The second box encompasses the variables employed to assess the developed learning module. These variables include content, instructional design, and technical design. These variables serve as the basis for inputs and recommendations aimed at improving the learning module. The third box presents the inputs and recommendations derived from the evaluation process, which can be used to enhance the learning materials effectiveness and usability.

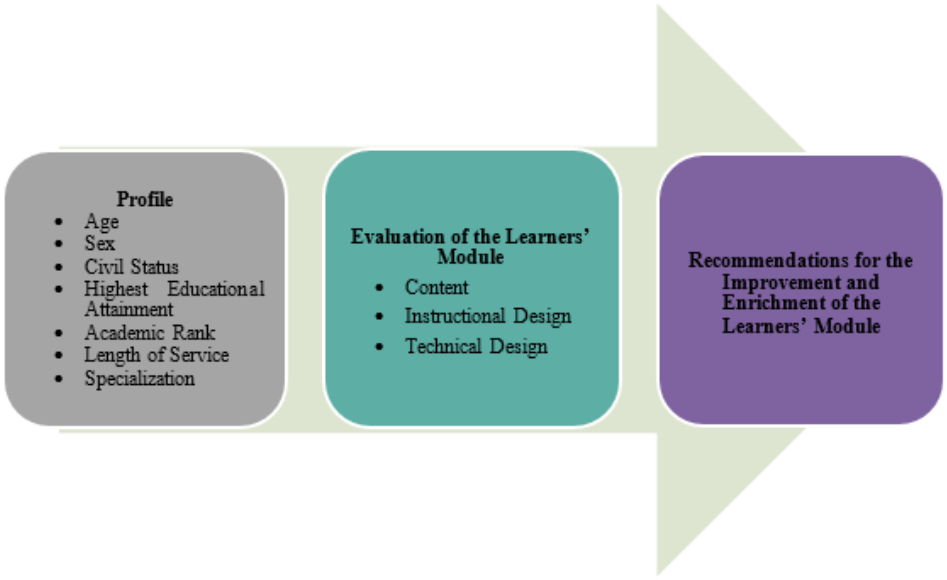

Figure1. Conceptual Paradigm of the Study

II. RESEARCH METHODOLOGY

Research Design

The study employed a descriptive research design to delineate the characteristics of the population under investigation. Its principal aim is to illustrate the essence of the demographic segment (Bhat, 2018). Developmental research, on the other hand, engages in the production of knowledge with the ultimate goal of refining instructional design, development, and evaluation process (Richey and Nelson, 2001).

Research Participants

The respondents of the study were science subject experts and professional education instructors from the three campuses of President Ramon Magsaysay State University - Iba (10 or 50%), Botolan (1 or 5%), and San Marcelino (9 or 45%). The respondents were chosen through purposive-convenience sampling technique. In purposive sampling, specific individuals are strategically selected to be part of the sample. This selection is guided by the assumption that these individuals reflect the characteristics and experiences of the entire

population, enabling researchers to gain insights into a particular topic or phenomenon. This method is commonly used in qualitative research, and it allows researchers to make the most of their available resources by selecting cases that are rich in information (Etikan, 2016. Convenience sampling, on the other hand, allows researchers to collect basic data and identify trends without the added complexities of using a randomized sample. It can also be useful for uncovering relationships between different phenomena (Explorable.com, 2009).

Research Instrument

The evaluation instrument for the module consists of three sections. The first section aims to gather demographic information about the respondents, such as their age, sex, marital status, highest level of education, academic rank, years of service, and area of specialization. The second section includes an adopted assessment tool to the evaluate the module based on its content, instructional design, and technical aspects. Finally, the third part is the open-ended question asking for the respondents' suggestions for improving the module.

Data Gathering Procedure and Analysis

Evaluation of the learning module by experts, using the adopted evaluation tool by Alagadan et. al (2023), determined if further revisions and improvement must be done on the material developed. The module was evaluated by subject experts to determine its validity and usability especially in terms of content. Professional education instructors were also asked to evaluate the module to determine its validity and usability especially in terms of the technical design and assessment tools used in the module after asking permission to campus and college heads. The researchers evaluated the respondents' evaluations using a combination of quantitative and qualitative analysis. To analyze the quantitative data, MS Excel 2010 and SPSS version 20 were utilized. Statistical methods such as frequency and percentage distribution, mean comparison, standard deviation (SD) computation, analysis of variance (ANOVA) were employed. The objective of these methods was to determine statistically significant differences in the evaluations provided by the respondents when grouped by profile variables. Additionally, a qualitative analysis was conducted using thematic analysis of open-ended questions. This analysis provided a deeper understanding of the perspectives and experiences of the respondents.

III. RESULTS AND DISCUSSION

The succeeding tables present the evaluation of the developed Module in Earth and Life Science for SHS.

Profile of the Student-Respondents

Table 1 shows Majority of the teacher-respondents which is 6 or 30% are aged 31 to 35, 5 or 25% are aged 25 and below, 3 or 15% are aged 36 to 40, 2 or 10% are aged 26 to 30, and 1 or 5% are aged 41 to 45, 46 to 50, and 56 and above. Of the 20 teacher-respondents, 4 or 20% are males while 16 or 80% are females. Most of the teacher-respondents, 11 or 55% are single, 7 or 35% are married and 2 or 10% are widowed. In terms of highest educational attainment, most of the teacher-respondents, 13 or 65% are BS/AB with master's units. MA/MS holder composed 6 or 30% of the 20 teacher-respondents and only 1 or 5% is Ph.D./Ed.D holder. In terms of academic rank, most of the respondents, 16 or 80% are instructors while 4 or 20% are professors. Out of 20 teacher-respondents, 11 or 55% of the teacher-respondents have a length of service below 5 years, 3 or 15% have 5 to 10 years and 11 to 15 years, and 1 or 5% has 26 to 30 years, 31 to 35 years and 36 to 40 years. A total of 8 or 40% are specialized in Biological Science, 2 or 10% are in Physical Science and Physics, 4 or 20% are in Chemistry, 1 or 5% in General Science, and 3 or 15% in Professional Education.

According to Alufohai and Ibhafidon (2015), the age of teachers has significant effect on the students' academic achievement emphasizing that those students taught by teachers between the ages of 21 to 34 years achieved higher score compared to those of 49 and above.

Table 1. Frequency and Percent Distribution of Respondents

	Range	Frequency	Percent
Age	25 and below	5	25
	26 to 30	2	10
	31 to 35	6	30
	36 to 40	3	15
	41 to 45	1	5
	46 to 50	1	5
	51 to 55	1	5
	56 and above	1	5
	Total	**20**	**100**

Sex	Male	4	20
	Female	16	80
	Total	**20**	**100**
Civil Status	Single	11	55
	Married	7	35
	Widowed	2	10
	Total	**20**	**100**
Highest Educational Attainment	BS/AB with master's units	13	65
	MA/MS holder	6	30
	Ph.D./Ed.D. holder	1	5
	Total	**20**	**100**
Academic Rank	Instructor	16	80
	Professor	4	20
	Total	**20**	**100**
Length of Service	Below 5 years	11	55
	5 to 10 years	3	15
	11 to 15 years	3	15
	26 to 30 years	1	5
	31 to 35 years	1	5
	36 to 40 years	1	5
	Total	**20**	**100**
Specialization	Biological Science	8	40
	Physical Science	2	10
	Chemistry	4	20
	Physics	2	10
	General Science	1	5
	Professional Education	3	15
	Total	**20**	**100**

In the study conducted by Shah and Udgaonkar (2018), students did not give much attention to gender for there is no clear preference while many opted for female teachers attributed to their sincerity, better compassionate approach, understanding, and helping students out.

According to Alufohai and Ibhafidon's 2015 research, teachers' marital status significantly impacts students' academic performance. Students of the married teachers had higher scores compared to students of single teachers.

In contrast, Magsayo's study in 2009 revealed that teachers with only a Bachelor's Degree tend to have students who perform better in the National Achievement Test. Interestingly, the study found an inverse relationship between teacher's educational attainment and students' achievement in grammar.

In the 20th century, educational reforms adopted more professional approach to teacher licensing, enhancing the profession's image and prestige, as Ravitch (2003) concluded

Podolsky (2016) stated that teaching experience is positively correlated with students' achievement, indicating that teachers improve their effectiveness as they gain experience in the profession. However, in a study conducted by Zhang (2008), the years of teaching in science were not directly linked to students' science achievement.

Proponents of teacher specialization agree that grouping teachers by subject areas offers several benefits as outlined by Fryer (2016). These advantages include the teacher's ability to develop deeper mastery of the subject content, dedicate more time to lesson planning, and potentially enhance teacher retention rates. Attia's (2017) study suggests that teachers who specialize in their teaching subjects can provide students with authentic experiences and effectively address complex content-related questions. Moreover, Blazar (2016) suggests that selectively recruiting teachers with content-area expertise can improve the quality of classroom teaching.

Evaluation of the Module in terms of content, instructional design and technical design

Content: As shown in Table 2, the evaluators have seen the Earth and Life Science Learner's Module in terms of content as strongly agree as revealed by the overall mean of 3.80 and standard deviation of 0.18. It can also be noted that the statement with highest mean of 4.00 is that the content is based on the grade level standards of the K to 12 curriculum. The statement with the lowest mean (3.55) with a standard deviation of

0.51 is that the content integrates "real-world" experiences. All statements have a verbal description of highly evident. Padmapriya (2015) stated that higher level mean score was achieved by those students treated with modular approach compared to those taught through activity method.

Instructional Design: Table 3 shows that the evaluators have seen the Earth and Life Science Learner's Module in terms of instructional design as strongly agree as revealed by the overall mean of 3.78 and standard deviation of 0.22. Most of the instructional design standard was seen strongly agree except for "The resource encourages group interaction." which is seen as agree with a mean of 3.25 and standard deviation of 0.72. Nardo (2017) stated that modular instruction is an alternative instructional design wherein instructional materials developed based on the needs of the students are used. Further, the researcher stated that using modules for instruction helps learners learn on their own, develop sense of responsibility in accomplishing tasks, and learn how to learn.

Table 2. Evaluation of the Earth and Life Science Module for SHS in terms of Content

STATEMENT	Mean	Standard Deviation	Verbal Description	Rank
CONTENT				
1. The content is based on the grade level standards of the K to 12 curriculum.	4.00	0.00	Strongly Agree	1
2. The contents meet the learning standards of the K to 12 curriculum.	3.95	0.22	Strongly Agree	2
3. The scope and learning targets are appropriate to students' needs.	3.85	0.37	Strongly Agree	5
4. The material provides sufficient knowledge and skill.	3.60	0.60	Strongly Agree	9
5. The level of difficulty is appropriate for intended students.	3.65	0.49	Strongly Agree	7
6. The content integrates "real-world" experiences.	3.55	0.51	Strongly Agree	10
7. The activities are relevant to the topic presented.	3.90	0.31	Strongly Agree	4
8. The content provides relevant information.	3.95	0.22	Strongly Agree	2
9. The activities provide practical work.	3.65	0.49	Strongly Agree	7
10. The references used are updated.	3.85	0.37	Strongly Agree	5
Total	**3.80**	**0.18**	Strongly Agree	

Note: Strongly Agree (SA) 3.50-4.00; Agree (A) 2.50-3.49; Disagree (D) 1.50-2.49; Strongly Disagree (SD) 1.00-1.49

Technical Design: As shown in Table 4, the evaluators strongly agreed in the Earth and Life Science Learner's Module in terms of technical design as revealed by the overall mean of 3.83 and standard deviation of 0.09. It can be observed that the highest mean (3.90) with a standard deviation of 0.3 is in terms of appropriate illustrations/visuals and correct arrangement and sequence of the material and the lowest mean (3.60) with a standard deviation of 0.60 is in terms of the resource makes effective use of the various mediums. The results of the study conducted by Nardo and Hufana (2014) suggested that modules should be developed in accordance to the principles of instructional development.

Table 3. Evaluation of the Earth and Life Science Module for SHS in terms of Instructional Design

STATEMENT	Mean	Standard Deviation	Verbal Description	Rank
INSTRUCTIONAL DESIGN				
1. The instructional goals and learner objectives are clearly stated.	3.85	0.37	Strongly Agree	5
2. The material promotes student engagement.	3.80	0.41	Strongly Agree	6
3. The methodology promotes the development of communication skills and encourages student creativity.	3.55	0.69	Strongly Agree	9
4. The resource encourages group interaction.	3.25	0.72	Agree	10
5. The resource encourages students to work	3.95	0.22	Strongly Agree	2

independently.				
6. The material is well organized and structured.	3.80	0.41	Strongly Agree	6
7. The learning material is congruent to the K to 12 curriculum.	3.95	0.22	Strongly Agree	2
8. The concepts are clearly introduced, and developed.	4.00	0.00	Strongly Agree	1
9. Technical terms are consistently explained.	3.90	0.31	Strongly Agree	4
10. Appropriate assessment tools are provided.	3.70	0.57	Strongly Agree	8
Total	**3.78**	**0.22**	Strongly Agree	

Note: Strongly Agree (SA) 3.50-4.00; Agree (A) 2.50-3.49; Disagree (D) 1.50-2.49; Strongly Disagree (SD) 1.00-1.49

Table 4. Evaluation of the Earth and Life Science Module for SHS in terms of Technical Design

STATEMENT	Mean	Standard Deviation	Verbal Description	Rank
TECHNICAL DESIGN				
1. Appropriate support materials are provided.	3.85	0.37	Strongly Agree	2
2. The visual design is effective and interesting.	3.85	0.37	Strongly Agree	2
3. The illustrations/visuals are appropriate.	3.90	0.31	Strongly Agree	1
4. The character size/typeface is appropriate.	3.85	0.37	Strongly Agree	2
5. The layout is logical and consistent.	3.85	0.37	Strongly Agree	2
6. The user can easily employ the material.	3.80	0.41	Strongly Agree	8
7. The packaging design is suitable for the classroom/library.	3.85	0.37	Strongly Agree	2
8. The resource makes effective use of the various mediums.	3.60	0.60	Strongly Agree	10
9. The material is arranged in correct sequence.	3.90	0.31	Strongly Agree	1
10. The material provides activities that will sustain interest.	3.80	0.52	Strongly Agree	8
Total	**3.83**	**0.09**	Strongly Agree	

Note: Strongly Agree (SA) 3.50-4.00; Agree (A) 2.50-3.49; Disagree (D) 1.50-2.49; Strongly Disagree (SD) 1.00-1.49

Test of Differences in the Evaluation of Module by Teacher- Respondents when Grouped According to Profile Variables

Table 5. Analysis of Variance (ANOVA) on the Significant Difference on the Evaluation of the Module in Terms of Content Standards

Source of Variance		Sum of Squares	df	Mean Square	F	Sig.	Decision	Interpretation
Age	Between Groups	0.223	7	0.032	0.608	0.739	Accept H_0	Not Significant
	Within Groups	0.627	12	0.052				
	Total	0.849	19					
Sex	Between Groups	0.105	1	0.105	2.542	0.128	Accept H_0	Not Significant
	Within Groups	0.744	18	0.041				
	Total	0.849	19					
Civil Status	Between Groups	0.176	2	0.088	2.221	0.139	Accept H_0	Not Significant
	Within Groups	0.674	17	0.040				
	Total	0.850	19					
Highest Educational Attainment	Between Groups	0.019	2	0.010	0.197	0.823	Accept H_0	Not Significant
	Within Groups	0.830	17	0.049				
	Total	0.849	19					
Academic Rank	Between Groups	0.084	1	0.084	1.988	0.176	Accept H_0	Not Significant
	Within Groups	0.765	18	0.042				
	Total	0.849	19					
Length of Service	Between Groups	0.266	4	0.067	1.714	0.199	Accept H_0	Not Significant
	Within Groups	0.583	15	0.039				
	Total	0.849	19					
Specialization	Between Groups	0.242	4	0.061	1.497	0.253	Accept H_0	Not Significant
	Within Groups	0.607	15	0.040				
	Total	0.849	19					

**Significant at a=0.05*

Table 5 shows that there is no significant difference in the evaluation of the module by the teacher-respondents as to content standards when grouped according to age, sex, civil status, highest educational attainment, academic rank, length of service, and specialization manifested in the computed significance of p-values of 0.739, 0.128, 0.139, 0.823, 0.176, 0.199 and 0.253 respectively which are all higher than (>) 0.05 alpha level of significance, therefore, the null hypothesis is accepted, that there is no significant difference in the evaluation of the module by teacher-respondents in terms of content when grouped according to profile variables.

Guido (2014) concluded that instructional modules in science and engineering are effective for students' knowledge adaptation. The evaluators also found out that the module as very valuable to the course which makes learning experience well stimulated. The study also affirms that the realization of appropriateness, development and comprehension of competency must be well identified for it will help students' progress.

Table 6. Analysis of Variance (ANOVA) on the Difference on the Evaluation of the Module in terms of Instructional Design

Source of Variance		Sum of Squares	df	Mean Square	F	Sig.	Decision	Interpretation
Age	Between Groups	0.263	7	0.038	0.630	0.723	Accept H_0	Not Significant
	Within Groups	0.715	12	0.060				
	Total	0.978	19					
Sex	Between Groups	0.028	1	0.028	0.533	0.475	Accept H_0	Not Significant
	Within Groups	0.949	18	0.053				
	Total	0.978	19					

Civil Status	Between Groups	0.071	2	0.035	0.665	0.527	Accept H_0	Not Significant
	Within Groups	0.907	17	0.053				
	Total	0.978	19					
Highest Educational Attainment	Between Groups	0.155	2	0.077	1.601	0.231	Accept H_0	Not Significant
	Within Groups	0.823	17	0.048				
	Total	0.977	19					
Academic Rank	Between Groups	0.078	1	0.078	1.564	0.227	Accept H_0	Not Significant
	Within Groups	0.899	18	0.050				
	Total	0.978	19					
Length of Service	Between Groups	0.314	4	0.078	1.772	0.187	Accept H_0	Not Significant
	Within Groups	0.664	15	0.044				
	Total	0.978	19					
Specialization	Between Groups	0.377	4	0.094	2.351	0.101	Accept H_0	Not Significant
	Within Groups	0.601	15	0.040				
	Total	0.978	19					

**Significant at a=0.05*

Table 6 shows that there is no significant difference in the evaluation of the module by the teacher-respondents as to instructional design when grouped according to age, sex, civil status, highest educational attainment, academic rank, length of service, and specialization manifested in the computed significance of p-values of 0.723, 0.475, 0.527, 0.231, 0.227, 0.187 and 0.101 respectively which all are higher that (>) 0.05 alpha level of significance, therefore the null hypothesis is accepted that there is no significant difference in the evaluation of the module by teacher-respondents in terms of instructional design when grouped according to profile variables.

Table 7 shows that there is no significant difference in the evaluation of the module by the teacher-respondents as to technical design when grouped according to age, sex, civil status, highest educational attainment, academic rank, length of service, and specialization manifested in the computed significance of p-values of 0.776, 0.130, 0.489, 0.577, 0.130, 0.119, and 0.222 respectively, therefore the null hypothesis that there is no significant difference in the evaluation of the module by teacher-respondents in terms of technical design when grouped according to profile variables is accepted.

Table 7. Analysis of Variance (ANOVA) on the Difference on the Evaluation of the Module in terms of Technical Design

Source of Variance		Sum of Squares	df	Mean Square	F	Sig.	Decision	Interpretation
Age	Between Groups	0.225	7	0.032	0.559	0.776	Accept H_0	Not Significant
	Within Groups	0.692	12	0.058				
	Total	0.917	19					
Sex	Between Groups	0.113	1	0.113	2.516	0.130	Accept H_0	Not Significant
	Within Groups	0.805	18	0.045				
	Total	0.917	19					
Civil Status	Between Groups	0.074	2	0.037	0.747	0.489	Accept H_0	Not Significant
	Within Groups	0.843	17	0.050				
	Total	0.917	19					
Highest Educational Attainment	Between Groups	0.057	2	0.029	0.568	0.577	Accept H_0	Not Significant
	Within Groups	0.860	17	0.051				

	Total	0.917	19					
Academic Rank	Between Groups	0.113	1	0.113	2.516	0.130	Accept H_0	Not Significant
	Within Groups	0.805	18	0.045				
	Total	0.917	19					
Length of Service	Between Groups	0.339	4	0.085	2.195	0.119	Accept H_0	Not Significant
	Within Groups	0.579	15	0.039				
	Total	0.918	19					
Specialization	Between Groups	0.276	4	0.069	1.615	0.222	Accept H_0	Not Significant
	Within Groups	0.641	15	0.043				
	Total	0.917	19					

**Significant at a=0.05*

Recommendations of Respondents for the Improvement of the Module

Table 8 shows the teachers' recommendations in improving the learners' material. The findings revealed that out of 20 respondents, three recommended improving the learners' material in terms of inclusion of rubrics at the end part of the material. Some teachers have recommendations such as (TR1) to provide rubrics for grading the students if in case performance tasks will be required, (TR8) suggested to provide assessment rubrics for the tasks which require students to create products/ outputs and (TR19) to provide scoring rubrics for the activities if possible at the end of the material. It was also recommended that revision of the activities in the learners' material be done by (TR1) including discovery learning in the activity and adding activities to develop student skills.

Table 8. Respondents' Recommendations in Improving the Earth and Life Science Module for Senior High School

Theme	Frequency
Revision of the activities in the learners' material	1
Inclusion of rubrics at the end part of the material	3
Pagination of the module	1
Citation of authors and references	2
Test construction	1
Contextualization and localization of the material	1

IV. CONCLUSION AND RECOMMENDATIONS

The respondents generally evaluated the Earth and Life Science Learner's Module as "strongly agree" in terms of content, instructional design, and technical design.There is no significant difference on the evaluation of the learners' material based on the assessment of teacher-respondents when grouped according to profile variables.

The material can be used as instructional material or supplementary material for Earth and Life Science, a core subject of the Senior High School. Some revisions such as the addition of activities and illustrations or pictures to further improve the module. Testing and utilization of the developed learners' module should be done in larger population and diverse group of learners to further determine its validity and usability. The developed module could be used and evaluated by other Earth and Life Science Senior High School instructors to determine possible revisions and further enrichment.

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