

# Earth and Life Science Innovative Supplementary Materials towards Enhancing Students' Cognitive Engagement and Academic Performance

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## Abstract

The study was conducted to investigate the effectiveness of Earth and Life Science Innovative Supplementary Materials (ELSISM) in enhancing Grade 11 students' cognitive engagement and academic performance in Earth and Life Science.

The Descriptive Design on the Method of Research was applied towards enhancing and motivate the students was used in the study. Survey Questionnaires, diagnostic test, summative test, and scores from the lessons in the developed Earth and Life Innovative Supplementary Materials were the tools used in the conduct of gathering data and information for the research. Descriptive Statistics were used to determine the significant effect and validity of the supplementary materials for students composed of 40 TVL-Grade 11 of the SHS students enrolled in Lowland Integrated National High School.

The finding shows that level of Earth and Life Science Innovative supplementary materials components were very great extent among the respondents and show a high degree of quality in each of the assessed components. This mean that, the Earth and Life Science Innovative Supplementary Materials show a high degree of quality in every area assessed, which helps students learn and become more involved in the material.

By incorporating the Earth and Life Science Innovative supplementary materials the results highlight how crucial additional resources are for encouraging different facets of students' cognitive involvement.

This implies that the students performed better after the utilization of the Earth and Life Science Innovative Supplementary Materials. Their level of student's performance has significantly improved from low to very high.

Lastly, the effect of Earth and Life Science Innovative supplementary materials on student's cognitive engagement significant, by encouraging curiosity, active involvement, and teamwork, the usage of Earth and Life Science Innovative Supplementary Materials improves students' cognitive engagement overall.

On the basis of the foregoing findings, the following conclusion was drawn. As a result, the researcher concludes the rejection of the first hypothesis and comes to the conclusion that students' academic performance differs significantly when they use the Earth and Life Science Innovative Supplementary Materials.

In comparison to students who were used the traditional education alone, there is a statistically significant difference in the cognitive engagement level of students who were used Earth and Life Science education supplemented with Earth and Life Science Innovative supplementary materials. As a result, thus rejecting the second null hypothesis.

In conclusion, it showed that using Earth and Life Science Innovative Supplementary Materials improves students' academic performance and cognitive engagement. These results proved how useful and important it is to include supplemental materials in Earth and Life Science curricula in order to improve student learning outcomes and engagement.

Based on the conclusions made, it is recommended that policy makers use the insights gained from this study to shape educational policies that support student success. Include resource allocation, decision-making, and creating an environment that facilitates effective teaching and learning.

*Keywords:* Cognitive engagement; academic performance; supplementary materials

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## 1. Introduction

Earth and Life Science, like many other subjects, can be challenging for several reasons. While it offers profound insights into the natural world, its complexity and abstract concepts can make it difficult for many students. The quest for increased cognitive engagement and higher academic achievement is a common goal in the field of education. Every educator strives to create a learning environment in which students are active participants in their own education rather than only passive users of knowledge. But doing so has proven to be a difficult task, particularly in fields like Earth and Life Science. Obstacles for educators to overcome include the complexity of technological ideas, abstract theories, and the requirements of hands-on experimentation.

The idea of additional resources has gained popularity as a means of addressing these issues and revolutionizing how we approach Earth and Life Science education. By offering cutting-edge, interactive tools that pique students' interest and pique their curiosity, these materials are intended to supplement conventional teaching techniques. The Earth and Life Science Innovative Supplementary Materials is one of such innovative strategy.

Through the prism of Earth and Life Science Innovative Supplementary Materials, it set out on a trip in this investigation from the overall educational landscape to the particular domain of science education. Before focusing on the novel and revolutionary possibilities of Earth and Life Science, it is to explore the broader backdrop of educational difficulties and the pursuit of greater cognitive engagement and academic success.

Engaging students and enhancing performance remain concerns, for educators in today's ever-evolving education landscape. To address these concerns educators are increasingly turning to approaches that combine learning with modern teaching resources. One such approach gaining popularity is the integration of materials into the classroom, such as the Earth and Life Science Innovative Supplementary Materials. This is a combination of science concepts, hands-on activities, and cutting-edge technology designed to captivate young learners' minds and promote their active participation in learning. In this introduction, it will explore the importance of the Earth and Life Science Innovative Supplementary Materials as a tool for fostering engagement and academic achievement, among developing students. The goal of this study is to explore the potential of Earth and Life Science Innovative Supplementary Materials in revolutionizing Science education and creating a lasting impact, on the generations. It delved into its origins, components, and how it could shape the landscape.

The researcher found out how the Earth and Life Science Innovative Supplementary Materials, with its distinct fusion of Earth and Life Science ideas, interactive experiments, and technological integration, serves as a light of hope in the struggle to improve the learning experiences of developing learners by following this path. This journey has the potential to illuminate the amazing influence Earth and Life Science Innovative Supplementary Materials can have in reshaping the Earth and Life Science education landscape and influencing the academic achievements of the following generation.

### 1.1 Statement of the Problem

This study seeks to provide answers to the following questions:

1. What is the level of Earth and Life Science Innovative Supplementary Materials components in terms of:
  - 1.1 learning objectives;
  - 1.2 contents;
  - 1.3 learning task; and
  - 1.4 reflection learning?
2. What is the level of Earth and Life Science Innovative Supplementary Materials characteristics in terms of:
  - 2.1 appropriateness;
  - 2.2 design; and
  - 2.3 usefulness?
3. What is the level of students' cognitive engagement while using the Earth and Life Science Innovative Supplementary Materials in terms of:
  - 3.1 information retention;
  - 3.2 task-orientation;
  - 3.3 peer collaboration;
  - 3.4 learning management; and
  - 3.5 self-efficacy?
4. What is the student's performance in terms of:
  - 4.1 diagnostic test; and
  - 4.2 summative test
5. Is there a significant difference in the students' academic performance in terms of diagnostic and summative test?
6. Is there a significant effect on using Earth and Life Science Innovative Supplementary Materials on student's cognitive engagement?

## 2. Methodology

The study applied the Descriptive Design on the Method of Research to enhanced and motivated the Grade 11 students of Lowland INHS based on components and characteristics of developed supplementary material. The objective of the study is to investigate the impact of the Earth and Life Science Innovative supplementary materials on cognitive engagement and to assess the effect of the Earth and Life Science Innovative supplementary materials on academic performance. It served as a diagnostic test, after-testing, an effective descriptive design to the TVL-Grade 11 of the senior high school students used by the researcher.

## 3. Results and Discussion

This chapter deals with the presentation, the analysis and interpretation of data gathered on the relationship of Earth and Life Science innovative supplementary materials towards enhancing students' cognitive engagement and academic performance. It also enumerates the different results and discusses the results that were yielded from the treatment of the data that was gathered in this study.

### Level of Validity of Earth and Life Science Innovative Supplementary Materials Components

Earth and Life Science Innovative Supplementary Materials was used by Grade 11 students in

Lowland Integrated National High School. The supplementary materials were shown to 40 senior high school students from two sections of the same grade level. The supplementary materials consist of four lessons and each lesson has various learning task to do related on the learners' cognitive ability and to enhance their academic performance.

There are distinct qualities that enhance the efficacy of educational experiences are found in each of these variables: learning objectives, content, learning task, and reflection learning. Together, they improve learning outcomes, give learners more agency, and promote a culture of lifelong learning and development when they are properly connected, planned, and used.

The table following table showing the results of the data gathered in each lesson as well as the result of diagnostic and summative test.

**Table 1.** Level of Earth and Life Science Innovative Supplementary Materials Components in Terms of Learning Objectives

STATEMENTS	MEAN	SD	REMARKS
The objectives of supplementary material are clear and easy to understand	4.25	0.78	Strongly Agree
The objectives of the supplementary material helped to understand what was expected	4.38	0.74	Strongly Agree
The objectives are aligned with the content and assessment	4.18	0.71	Agree
The objectives are attainable	4.17	0.84	Agree
The objectives are appropriate for the lesson content.	4.28	0.82	Strongly Agree
<b>Weighted Mean</b>	4.24		
<b>SD</b>	0.68		
<b>Verbal Interpretation</b>	Very Great Extent		

Table 1 illustrates the level of validity of Earth and Life Science Innovative supplementary materials components in terms of learning objectives. Also shows the statements, mean, standard deviation and remarks.

Respondents strongly agree that the objective of the supplementary materials help students to understand what is expected to learn ( $M=4.38$ ,  $SD=0.74$ ). Additionally, the supplementary materials include attainable goals for students to for students to maximize their potential to learn.

On the other hand, it should give more attainable goals for the students to maximize the potential to learn from it. While the mean is slightly lower ( $M = 4.17$  and  $SD=0.84$ ), it still indicates a high level of validity of components in terms of objectives.

The level of validity of Earth and Life Science Innovative supplementary materials components in terms of learning objectives attained a weighted mean score of 4.24 and a standard deviation of 0.68 and was Great Extent among the respondents.

This result is supported by Smith (2019) stated that assessing the quality and content of supplementary educational materials across various subjects examines the alignment of these materials with educational standards and their effectiveness in supporting student learning.

**Table 2.** Level of Earth and Life Science Innovative supplementary materials components in terms of contents

STATEMENTS	MEAN	SD	REMARKS
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The developed Supplementary Material provides learning tasks suited to the learners' developing cognitive engagement.	4.33	0.69	Strongly Agree
The developed Supplementary Material contains activities that are relevant to the lesson.	4.28	0.82	Strongly Agree
The developed Supplementary Material offers various activities that can be easily accomplished.	4.30	0.76	Strongly Agree
The content of the developed Supplementary Material can be a great substitute for books or manuals which may be difficult to process.	4.38	0.70	Strongly Agree
The content of the developed supplementary materials is appropriate to the students learning goals.	4.33	0.67	Strongly Agree
<b>Weighted Mean</b>	4.32		
<b>SD</b>	0.66		
<b>Verbal Interpretation</b>	Very Great Extent		

Table 2 illustrates the level of validity of Earth and Life Science Innovative supplementary materials components in terms of content. Also shows the statements, mean, standard deviation and remarks.

Respondent strongly agree that supplementary materials help students to gain knowledge based on the mean ( $M=4.38$  and  $SD=0.70$ ) suggested that the content of the supplementary materials can be a great substitute to supplement the learning needs of the students. On the other hand, it should provide activities aligned to the contents. While the mean is slightly lower ( $M=4.28$  and  $SD=0.82$ ), it still indicates a high level of components in terms of content.

The level of validity of Earth and Life Science Innovative supplementary materials components in terms of content attained a weighted mean score of 4.32 and a standard deviation of 0.66 and was Great Extent among the respondents.

This mean that the content of the supplementary materials provides learning activities that may develop the learners' cognitive engagement. The learning activities in supplementary materials should be attainable so that the sense of fulfillment and self-confidence of the students elevate. It also helps the better understanding of the students regarding the lesson.

**Table 3.** Level of Earth and Life Science Innovative supplementary materials components in terms of learning task

STATEMENTS	MEAN	SD	REMARKS
The developed supplementary material contains simple to complex tasks that can be properly answered	4.35	0.74	Strongly Agree
The developed supplementary material provides learning tasks that relate directly to the objectives of the lessons.	4.48	0.68	Strongly Agree
The developed supplementary material reflects on attainable objectives for each lesson.	4.43	0.64	Strongly Agree
The developed supplementary material focuses on the main goal of empowering cognitive	4.40	0.59	

engagement and academic performance The learning tasks of the supplementary materials are well organized	4.33	0.67	Strongly Agree Strongly Agree
<b>Weighted Mean</b>	4.50		
<b>SD</b>	0.41		
<b>Verbal Interpretation</b>	Very Great Extent		

Table 3 illustrates the level of validity of Earth and Life Science Innovative supplementary materials components in terms of learning tasks. Also shows the statements, mean, standard deviation and remarks.

Respondents strongly agree that the learning tasks of the supplementary materials helps students to understand what is expected to learn. The mean ( $M=4.48$  and  $SD=0.68$ ) suggests that the learning tasks of the supplementary materials are aligned with learning objectives. On the other hand, the organization and instruction of the learning tasks provided must be clear and specific so that the learners can follow them correctly and efficiently. While the mean is slightly lower ( $M=4.33$  and  $SD=0.67$ ), it still indicates a high level of components in terms of learning tasks.

The level of validity of Earth and Life Science Innovative supplementary materials components in terms of learning tasks attained a weighted mean score of 4.50 and a standard deviation of 0.41 and was Great Extent among the respondents.

This mean that the learning tasks of a supplementary materials contain clear instruction and organized. The Earth and Life Science Innovative Supplementary Materials demonstrate a high level of quality across all components evaluated, effectively supporting student learning and engagement in the subject matter.

**Table 4.** Level of Earth and Life Science Innovative supplementary materials components in terms of reflection learning

STATEMENTS	MEAN	SD	REMARKS
The developed supplementary material engaged in activities or exercises as part of the learning experience	4.63	0.54	Agree
The developed supplementary material assessed the understanding of concept and enhance the academic performance	4.35	0.72	Strongly Agree
The developed supplementary material contributes the ability to understand and apply the concept effectively	4.53	0.60	Strongly Agree
The developed supplementary material is helpful in developing the affective domain of learning.	4.25	0.67	Strongly Agree
The developed supplementary material provides subjective and formative assessment.	4.65	0.48	Strongly Agree
<b>Weighted Mean</b>	4.51		
<b>SD</b>	0.40		
<b>Verbal Interpretation</b>	Very Great Extent		

Table 4 illustrates the level of validity of Earth and Life Science Innovative supplementary materials components in terms of reflection learning. Also shows the statements, mean, standard deviation and

remarks.

Respondents strongly agree that the reflection learning of the supplementary materials help students to realize what have to learn. The mean ( $M=4.65$  and  $SD= 0.48$ ) provides reflective assessment through formative and subjective questioning. On the other hand, developing the affective domain for the learning outcome requires questions that would stimulate the critical thinking of the students. While the mean is slightly lower ( $M = 4.25$  and  $SD=0.67$ ), it still indicates a high level of components in terms of reflection learning.

The level of validity of Earth and Life Science Innovative supplementary materials components in terms of reflection learning attained a weighted mean score of 4.51 and a standard deviation of 0.40 and was Great Extent among the respondents.

This mean that, to maximize the learning outcome, it is important to give reflection to promote critical thinking for generalization. The innovative supplementary materials for Earth and Life Science exhibit a high degree of quality, thereby providing excellent support for students' learning and engagement with the subject matter.

Based on the results, the level of Earth and Life Science Innovative Supplementary Materials was interpreted to a very great extent among the respondents and show a high degree of quality in each of the assessed components. These resources successfully enhance student learning and foster a culture of lifelong learning and development. They are backed by relevant literature that highlights the significance of alignment with curriculum objectives and the inclusion of engaging activities.

### Level of Validity of Earth and Life Science Innovative Supplementary Materials Characteristics

The creative supplemental materials for Earth and Life Science that demonstrate appropriateness, deliberate design, and usefulness are essential for enhancing the educational process and encouraging students to grasp concepts at a deeper level. These resources, when thoughtfully chosen and incorporated into teaching strategies, raise student interest and encourage investigation into the exciting fields of Earth and life science.

**Table 5.** Level of validity of Earth and Life Science Innovative Supplementary Materials characteristics in terms of appropriateness

STATEMENTS	MEAN	SD	REMARKS
The content of supplementary materials appropriate for current academic level and understanding of the subject content	4.34	0.62	Strongly Agree
The content and complexity of the material align with the level of the subject coursework	4.20	0.61	Agree
It is suited to the specific learning objectives and goals of the subject objectives	4.10	0.74	Agree
The activities provide learning output appropriate to the level of the learners.	4.33	0.57	Strongly Agree
The design and overall appearance of the supplementary material is appropriate to the level of the students.	4.20	0.60	Agree
<b>Weighted Mean</b>	4.24		
<b>SD</b>	0.54		
<b>Verbal Interpretation</b>	Very Great Extent		

Table 5 illustrates the level of validity of Earth and Life Science Innovative supplementary materials characteristics in terms of appropriateness. Also shows the statements, mean, standard deviation and remarks.

Respondents strongly agree that the appropriateness of the supplementary materials motivating students to understand ideas more thoroughly. The mean ( $M=4.34$  and  $SD= 0.62$ ) shows that the other characteristic of the supplementary material is appropriate to the students' level of understanding and readiness. On the other hand, it should always provide objectives that are clear and specific to the learning content. While the mean is slightly lower ( $M = 4.10$  and  $SD=0.74$ ), it still indicates a high level of characteristics in terms of appropriateness.

The level of validity of Earth and Life Science Innovative supplementary materials characteristics in terms of appropriateness attained a weighted mean score of 4.24 and a standard deviation of 0.54 and was Great Extent among the respondents.

**Table 6.** Level of validity of Earth and Life Science Innovative Supplementary Materials characteristics in terms of design

STATEMENTS	MEAN	SD	REMARKS
The design of the developed supplementary material enhances the ability to engage with the content and activities effectively	4.43	0.55	Strongly Agree
The developed supplementary material uses appropriate text font, size and type.	4.20	0.88	Agree
The developed supplementary material makes use of colors that can be suited to the preferences of the learners.	4.03	0.86	Agree
The developed supplementary material contains visuals that fit the level of interests, knowledge, and skills of the target learners. The graphics of the supplementary material is good in the eye and interesting.	4.00 4.03	0.85 4.87	Agree Agree
<b>Weighted Mean</b> <b>SD</b> <b>Verbal Interpretation</b>	4.16 0.66 Great Extent		

Table 6 illustrates the level of validity of Earth and Life Science Innovative supplementary materials characteristics in terms of design. Also shows the statements, mean, standard deviation and remarks.

Respondents strongly agree that the design of the supplementary materials help students to visualize what is expected to learn. The mean ( $M=4.43$  and  $SD= 0.55$ ) shows that the design of the supplementary material is able to get the attention and focus of the learners. On the other hand, it also shows that the visual presentation is a great indicator to Improve the interest of the learners. While the mean is slightly lower ( $M = 4.00$  and  $SD=0.85$ ), it still indicates a high level of characteristics in terms of design.

The level of validity of Earth and Life Science Innovative supplementary materials characteristics in terms of design attained a weighted mean score of 4.16 and a standard deviation of 0.66 and was Great Extent among the respondents.

This mean that the colors, text and visual and graphics presentation of supplementary material should be planned according to the needs and readiness of the students as tis may greatly affect the engagement and focus of the learners to use and utilize the material given to them. The Design features improve the students efficiently and support educational learning.

**Table 7.** Level of validity of Earth and Life Science Innovative Supplementary Materials characteristics in terms of usefulness

STATEMENTS	MEAN	SD	REMARKS
The developed supplementary materials provide additional learning for the subject.	4.03	0.80	Agree
The developed supplementary materials are helpful in understanding and learning the subject	4.40	0.59	Strongly Agree
The developed supplementary materials help to enhance the understanding of subject concepts	4.43	0.59	Strongly Agree
The developed supplementary material are useful in the learning experience of the learners.	4.15	0.74	Agree
The developed supplementary materials are useful in improving the learning engagement of the learners.	4.20	0.87	Agree
<b>Weighted Mean</b>	4.25		
<b>SD</b>	0.55		
<b>Verbal Interpretation</b>	Very Great Extent		

Table 7 illustrates the level of validity of Earth and Life Science Innovative supplementary materials characteristics in terms of usefulness. Also shows the statements, mean, standard deviation and remarks.

Respondents strongly agree that the usefulness of the supplementary materials enhance the effectiveness of instruction. The mean ( $M=4.43$  and  $SD= 0.59$ ) shows that it integrating the learners' understanding of the subject. On the other hand, additional learning may need more engaging tasks and activities. While the mean is slightly lower ( $M = 4.03$  and  $SD=0.80$ ), it still indicates a high level of characteristics in terms of usefulness.

The level of validity of Earth and Life Science Innovative supplementary materials characteristics in terms of usefulness attained a weighted mean score of 4.25 and a standard deviation of 0.55 and was Very Great Extent among the respondents.

This indicates that in order for students to acquire a passion of learning, it is imperative that their educational experiences be improved. It might be a good idea to provide them more activities and knowledge by using supplemental resources.

Furthermore, the level of Earth and Life Science Innovative supplementary materials characteristics was interpreted to a very great extent among the respondents. The study aligns with existing research emphasizing the importance of supplementary materials in enhancing students' ability to solve problems and practice self-regulated learning in a variety of subject areas. By providing additional activities and knowledge through supplemental resources, it can help students become lifelong learners and enhance their educational experiences.

### Level of Students Cognitive Engagement

The creative supplementary materials related to Earth and Life Science are essential for encouraging students' cognitive involvement in a variety of ways. Through the promotion of information retention, task-orientation, peer collaboration, efficient learning management, and self-efficacy, these materials generate engaging and stimulating learning opportunities that enhance students' cognitive growth and enable significant comprehension of scientific ideas. Teachers can optimize learning outcomes in Earth and Life Science

teaching by utilizing supplemental materials that are thoughtfully designed and implemented that will increase students' cognitive engagement.

**Table 8.** Level of Students' cognitive engagement in terms of information retention

STATEMENTS	MEAN	SD	REMARKS
Focus on learning with multiple ways.	4.28	0.60	Strongly Agree
Utilize previous learning to promote new learning.	4.30	0.61	Strongly Agree
Gain practical experiences through experiential learning.	3.98	1.10	Agree
Visualize information and put it into context.	4.10	0.67	Agree
Connect topics from one another and assess this information through a thorough understanding.	4.16	0.66	Agree
<b>Weighted Mean</b>	4.16		
<b>SD</b>	0.57		
<b>Verbal Interpretation</b>	Great Extent		

Table 8 displays the level of students' cognitive engagement in terms of information retention.

The respondents strongly agree that the information retention ensures that they retain and recall essential knowledge and concepts long after the learning experience. The mean ( $M=4.30$  and  $SD=0.61$ ) shows that the learners are able to use previous knowledge and skills to promote new learning. On the other hand, learning through experiential learning may be used to gain practical experiences. While the mean is slightly lower ( $M=3.98$  and  $SD=1.10$ ), it still indicates a high level of students learning engagement in terms of information retention.

The level of students' cognitive engagement in terms of information retention attained a weighted mean score of 4.16 and a standard deviation of 0.57 and was Great Extent among the respondents.

This means that Earth and Life Science innovative supplementary materials can effectively support information retention among learners. It is important to assign assignments and activities that let students apply what they've learned thus far to acquire new information. Enhanced information retention contributes to deeper understanding, the application of learning to real-world situations are all facilitated by improved information retention.

**Table 9.** Level of Students cognitive engagement in terms of task-orientation

STATEMENTS	MEAN	SD	REMARKS
Focus on and devoted to complete certain tasks and performances.	4.18	0.68	Agree
Practice effective time management and prioritize what most in need.	4.23	0.62	Strongly Agree
Submit and accomplish all learning tasks on time.	4.03	0.66	Agree
Complete and manage the learning process at a given time.	4.38	0.77	Strongly Agree
Eager and initiative to finish the tasks assigned efficiently.	4.18	0.67	Agree
<b>Weighted Mean</b>	4.20		
<b>SD</b>	0.57		

<b>Verbal Interpretation</b>	<i>Great Extent</i>
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Table 9 shows the level of students' cognitive engagement in terms of task-orientation.

Respondents strongly agree that the task-orientation of the supplementary materials is particularly important for engaging students in inquiry-based learning, laboratory investigations, and project-based activities. The mean ( $M=4.38$  and  $SD= 0.77$ ) shows that the learners are able to complete, manage and accomplish various tasks on time and efficiently. On the other hand, they still need to learn to focus and have the initiative to finish all the given task. While the mean is slightly lower ( $M = 4.18$  and  $SD=0.68$ ), it still indicates a high level of students learning engagement in terms of task orientation.

The level of students' cognitive engagement in terms of task orientation attained a weighted mean score of 4.20 and a standard deviation of 0.57 and was Great Extent among the respondents.

This mean that, it is important to practice time management and identify the tasks that are needed priorities to promote work efficiency. Task-orientation enhances critical thinking abilities and a greater comprehension of scientific concepts by having students actively engage in practical projects and scientific investigation. It improves students educational experiences, helps them succeed academically, and gets them ready for challenges in Earth and Life Science.

**Table 10.** Level of Students' cognitive engagement in terms of peer collaboration

STATEMENTS	MEAN	SD	REMARKS
Encourage collaboration at the same time with autonomy from every member of the class.	4.45	0.60	Strongly Agree
Develop and promote social interaction with other learners and create a supportive learning community.	4.33	0.76	Strongly Agree
Learn how to share ideas, express opinions, and manage time efficiently.	4.38	0.74	Strongly Agree
Establish positive communication with other peers and classmates.	4.25	0.81	Strongly Agree
Develop the initiative to work together to accomplish a task.	4.38	0.77	Strongly Agree
<b>Weighted Mean</b>	4.35		
<b>SD</b>	0.64		
<b>Verbal Interpretation</b>	<i>Very Great Extent</i>		

Table 10 exhibits the level of Students' cognitive engagement in terms of peer collaboration.

Respondents strongly agree that peer collaboration help students to enhance the learning experience by developing communication skills, fostering cooperative learning strategies, promoting higher-order thinking, and supporting social and emotional learning. The mean ( $M=4.45$  and  $SD= 0.60$ ) shows that the learners practice collaboration with autonomy to execute different tasks given to them which are important to develop self-esteem of individual members. On the other hand, they should establish a good communication practices with each member of the group. While the mean is slightly lower ( $M = 4.25$  and  $SD=0.81$ ), it still indicates a high level of students learning engagement in terms of peer collaboration.

The level of students' cognitive engagement in terms of peer collaboration attained a weighted mean score of 4.35 and a standard deviation of 0.64 and was Great Extent among the respondents.

This means that in order to complete tasks more effectively, learners need improve their communication abilities. It will be much easier for them to complete assignments on time and effectively if

they take the initiative to share ideas and expertise.

Table 11 presents the level of students' cognitive engagement in terms of learning management.

The table provides useful information about students' cognitive involvement with regard to learning management, providing an insight into how they approach learning and personal development. The table displays the average scores, confidence intervals, and qualitative comments for a range of statements that represent the attitudes and actions of the students.

**Table 11.** Level of Students' cognitive engagement in terms of learning management

STATEMENTS	MEAN	SD	REMARKS
Focus on the process of learning and try to explore various kinds of knowledge acquisition.	4.00	0.85	Agree
Take time to reflect and allow self to recognize own strength and weaknesses.	4.05	0.81	Agree
Seek for other's feedback to improve self-learning progress.	4.15	0.70	Agree
Organize the things that are needed to help finishing one task at a time.	4.16	0.70	Agree
Avoid learning distractions and cultivate intrinsic motivation towards learning.	4.03	0.66	Agree
<b>Weighted Mean</b>	<i>4.09</i>		
<b>SD</b>	<i>0.70</i>		
<b>Verbal Interpretation</b>	<i>Great Extent</i>		

Table 11 presents the level of students' cognitive engagement in terms of learning management .

Respondents strongly agree that learning management of the supplementary materials help students for creating well-structured, engaging, and effective learning experiences. The mean ( $M=4.16$  and  $SD=0.70$ ) shows that the learners can prioritize and plan how to execute the tasks properly. They also seek others' opinion and feedback for improvement of learning process. On the other hand, trying various learning acquisition seems less effective when they already know their learning styles. While the mean is slightly lower ( $M = 4.00$  and  $SD=0.85$ ), it still indicates a high level of students learning engagement in terms of learning management.

The level of students' cognitive engagement in terms of learning management attained a weighted mean score of 4.09 and a standard deviation of 0.70 and was Great Extent among the respondents.

This mean that allowing students to identify their strength and weakness will help them focus on strengths and improve weaknesses. This would help them focus on the skills the needs improvement. Through learning management, differentiation, feedback, effective resource management, and self-regulated learning, educators can establish dynamic and supportive learning environments that enable students to excel academically and acquire critical skills.

Table 12 presents the students' cognitive engagement in terms of self-efficacy.

Self-efficacy stands as a fundamental concept, reflecting an individual's belief in their ability to accomplish specific tasks and goals. In Earth and Life Science, students with high levels of self-efficacy can take on challenging concepts with confidence and zeal, which can result in a deeper comprehension and improved memory of the material.

**Table 12.** Level of Students' cognitive engagement in terms of self-efficacy

STATEMENTS	MEAN	SD	REMARKS
Break tasks into smaller steps and achieve goals one by one.	4.28	0.60	Strongly Agree
Break tasks into smaller steps and achieve goals one by one.	4.23	0.62	Strongly Agree
Try new things and become committed for all the tasks given.	4.38	0.74	Strongly Agree
Improve abilities and skills by seeking new learning challenges.	4.15	0.70	Agree
Practice positivity and create opportunities towards the mastery of own's ability.	4.23	0.65	Strongly Agree
<b>Weighted Mean</b>	4.26		
<b>SD</b>	0.51		
<b>Verbal Interpretation</b>	Very Great Extent		

Table 12 demonstrates the level of students' cognitive engagement in terms of self-efficacy.

Respondents strongly agree that self-efficacy of the supplementary materials help in shaping students' motivation, goal-setting behaviors, resilience, learning strategies, emotional well-being, and academic achievement in students learning. The mean ( $M=4.38$  and  $SD=0.74$ ) shows that the learners want to try new things to acquire more knowledge. In doing so, they try to learn and execute at their best. On the other hand, trying and seeking various tasks brings challenges. While the mean is slightly lower ( $M=4.15$  and  $SD=0.70$ ), it still indicates a high level of students learning engagement in terms of self-efficacy.

The level of students' cognitive engagement in terms of self-efficacy attained a weighted mean score of 4.26 and a standard deviation of 0.51 and was Great Extent among the respondents.

This means that dividing up a task into smaller pieces may produce result in successful completion of each step. Maintaining an optimistic attitude will allow students to accomplish goals and enhance their abilities. Teachers may enable students to achieve academic success and build the self-confidence and abilities necessary for lifelong learning and scientific inquiry by cultivating self-efficacy beliefs in them through constructive criticism, mastery experiences, role modeling, and encouraging learning settings.

All things considered that the level of students' cognitive engagement was interpreted to a very great extent among the respondents. By incorporating the Earth and Life Science Innovative supplementary materials the results highlight how crucial additional resources are for encouraging different facets of students' cognitive involvement.

### Level of Student's Performance

Both diagnostic and summative test are essential for gauging the success of creative supplemental resources as well as students' performance in Earth and Life Science Innovative Supplementary Materials. Diagnostic test offer valuable insights on students' past knowledge and instructional requirements, which inform the choice and application of further resources. Summative test, on the other hand, function as thorough analyses of the learning objectives of students and offer insightful commentary on how additional resources affect students' performance. Teachers can get a thorough picture of their students' performance and make wise decisions to help them succeed in Earth and Life Science classes by combining diagnostic and summative evaluations.

**Table 13.** Level of student's performance in terms of diagnostic test

Score	f	%	Descriptive Equivalent
41 - 50	0	0.00	Outstanding
31 - 40	1	2.50	Very Satisfactory
21 - 30	7	17.50	Satisfactory
11 - 20	30	75.00	Fairly Satisfactory
0 - 10	2	5.00	Did not meet Expectation
<b>Total</b>	<b>40</b>	<b>100</b>	
<i>Weighted Mean</i>	16.15		
<i>SD</i>	5.61		
<i>Verbal Interpretation</i>	<i>Fairly Satisfactory</i>		

Table 13 presents the level of student's performance before and after the utilization of the Earth and Life Science Innovative Supplementary Materials in terms of diagnostic test. Out of total number of forty respondents "11 to 20" received the highest frequency of thirty (30) or 75.00% of the total population with descriptive equivalent of *Fairly Satisfactory*. While the scores "31 to 40" received the lowest frequency of one (1) or 2.50% of the total population with descriptive equivalent of *Satisfactory*.

With a (*Weighted Mean* = 16.15, *SD* = 5.61) it shows that the level of student's performance in terms of diagnostic test has a descriptive equivalent of *Fairly Satisfactory* has a descriptive equivalent of *Fairly Satisfactory*.

The diagnostic test results that show a "Fairly Satisfactory" degree of student performance in Earth and Life Science have significant effects on curriculum creation, instructional design, and student assistance programs. Teachers can improve student learning outcomes in Earth and Life Science education and foster continuous improvement by making appropriate use of this information.

This mean that it had proven that the diagnostic test is essential instrument in gathering data in research. The outcomes that have been mentioned and the researcher's presentation simply demonstrate how inevitable it is to conduct the diagnostic test, and the results tell for themselves.

**Table 14.** Level of student's performance in terms of summative test

Score	f	%	Descriptive Equivalent
41 - 50	3	7.50	Outstanding
31 - 40	20	50.00	Very Satisfactory
21 - 30	16	40.00	Satisfactory
11 - 20	1	2.50	Fairly Satisfactory
0 - 10	0	0.00	Did not meet Expectation
<b>Total</b>	<b>40</b>	<b>100</b>	
<i>Weighted Mean</i>	33.18		
<i>SD</i>	6.23		
<i>Verbal Interpretation</i>	<i>Very Satisfactory</i>		

Table 14 presents the level of student's performance before and after the utilization of the Earth and Life Science Innovative Supplementary Materials in terms of summative test.

Out of total number of forty respondents "31 to 40" received the highest frequency of twenty (20) or 50.00% of the total population with descriptive equivalent of *Very Satisfactory*. While the scores "11 to 20" received the lowest frequency of one (1) or 2.50% of the total population with descriptive equivalent of *Fairly Satisfactory*.

With a (*Weighted Mean = 33.18, SD = 6.23*) it shows that the level of student's performance before and after the utilization of the Earth and Life Science Innovative Supplementary Materials in terms of summative test has a descriptive equivalent of *Very Satisfactory*.

It proves that the Earth and Life Science Innovative Supplementary Materials have been found to be helpful in promoting student learning and achievement, as evidenced by the "Very Satisfactory" performance level on the summative test. This discovery has consequences for Earth and Life Science education's teaching methods, curriculum design, resource distribution, student involvement, ongoing development, and stakeholder communication.

This mean that summative tests are essential for assessing the efficacy of instructional activities and providing information for educational decision-making. Consequently, the study emphasizes how well Earth and Life Science Innovative Supplementary Materials work to improve students' performance and learning outcomes on final exams.

The synthesis as a whole emphasizes how crucial it is to use diagnostic and summative assessments when assessing how Earth and Life Science Innovative Supplementary Materials affect student performance and learning objectives. These evaluation instruments offer insightful data that guides teaching strategies and advances Earth and life science education throughout time.

**Test of Difference between the student's performance**

An investigation of the variation in student performance before and after the use of Earth and Life Science Innovative Supplementary Materials is shown. The purpose of this analysis is to evaluate how well these supplemental materials improve student learning outcomes and academic performance in Earth and Life Science. This table offers important insights into how innovative instructional approaches affect student performance by comparing performance data from diagnostic and summative-intervention evaluations.

**Table 15.** Test of Difference between the student's performance before and after the utilization of the Earth and Life Science Innovative Supplementary Materials

Earth and Life Science Innovation Kit	Diagnostic test		Summative test		Mean Difference	95% Confidence Interval of Difference		t	df	Sig (2-tailed)
	Mn	SD	Mn	SD		L	U			
	<i>performance</i>	16.15	5.61	33.18		6.23	17.03			

Legend: \*Significant at 0.05

Revealed in Table 15 is the test of difference between the student's performance before and after the utilization of the Earth and Life Science Innovative Supplementary Materials. Data obtained through a paired t-test indicated that the increase in the scores in *performance* is significant ( $p < 0.05$ ).

This implies that the students performed better after the utilization of the Earth and Life Science Innovative Supplementary Materials. Their level of student's performance has significantly improved from low to very high.

The table below presents the results of analysis examining the effect of use of Earth and Life Science Innovative supplementary materials components. The learning objectives, content, learning task and reflection learning have significant effect on student's cognitive engagement. The F-test of the overall model is significant ( $F(4, 35)$  with,  $p < 0.05$ ), indicating that the regression model is a good fit for the data.

**Table 16.** Test of Effect on the Components of Earth and Life Science Innovative supplementary materials components to the student's cognitive engagement

\*p&lt;0.05

information retention	<b>B</b>	<b>SE</b>	<b>β</b>	<b>t</b>	<b>p</b>
Constant	.408	.718		.568	.574
<i>learning objectives</i>		.19	.441	2.321*	.026
<i>content</i>		.223	.203	.908	.37
<i>learning task</i>		.188	-.17	-.92	.366
<i>reflection learning</i>		.183	.393	2.142*	.039
R-squared			.589		
Adjusted R-squared			.542		
Standard Error of the Estimate		.384			
F(4, 35)				12.54	.000
task-orientation	<b>B</b>	<b>SE</b>	<b>β</b>	<b>t</b>	<b>p</b>
Constant	.463	.587		.789	.435
<i>learning objectives</i>		.155	.738	4.753*	.000
<i>content</i>		.183	-.01	-.03	.974
<i>learning task</i>		.154	-.2	-1.3	.204
<i>reflection learning</i>		.15	.335	2.239*	.032
R-squared			.727		
Adjusted R-squared			.686		
Standard Error of the Estimate		.314			
F(4, 35)				23.31	.000
peer collaboration	<b>B</b>	<b>SE</b>	<b>β</b>	<b>t</b>	<b>p</b>
Constant	.796	.959		.83	.412
<i>learning objectives</i>		.254	.394	1.553	.129
<i>content</i>		.298	.166	.557	.581
<i>learning task</i>		.252	-.03	-.13	.898
<i>reflection learning</i>		.245	.29	1.183	.245
R-squared			.423		
Adjusted R-squared			.357		
Standard Error of the Estimate		.513			
F(4, 35)				6.402	.000
learning management	<b>B</b>	<b>SE</b>	<b>β</b>	<b>t</b>	<b>p</b>
Constant	-.27	.848		-.32	.749
<i>learning objectives</i>		.224	.789	3.518*	.001
<i>content</i>		.264	-.15	-.57	.569
<i>learning task</i>		.223	.13	.582	.564
<i>reflection learning</i>		.217	.243	1.121	.27
R-squared			.622		
Adjusted R-squared			.579		
Standard Error of the Estimate		.454			
F(4, 35)				14.39	.000
self-efficacy	<b>B</b>	<b>SE</b>	<b>β</b>	<b>t</b>	<b>p</b>
Constant	.811	.799		1.015	.317
<i>learning objectives</i>		.211	.208	.986	.331
<i>content</i>		.248	.251	1.012	.319
<i>learning task</i>		.21	.005	.022	.983
<i>reflection learning</i>		.204	.321	1.575	.124
R-squared			.462		
Adjusted R-squared			.4		
Standard Error of the Estimate		.427			
F(4, 35)				7.499	.000

This mean that the significant effects observed in the regression analysis highlight the importance of clearly defined learning objectives and opportunities for reflection in enhancing student cognitive engagement in Earth and Life Science education. However, the lack of significant effects for peer collaboration, content, learning task, and self-efficacy suggests that these factors may not have as strong a direct impact on cognitive engagement in this context. These findings can inform the design and implementation of Earth and Life Science innovative supplementary materials to better support student learning and engagement.

**Table 17.** Test of Effect on the characteristics of Earth and Life Science Innovative Supplementary Materials characteristics to the students' cognitive engagement

information retention	<b>B</b>	<b>SE</b>	<b><math>\beta</math></b>	<b>t</b>	<b>p</b>
Constant	.424	.517		.819	.418
<i>appropriateness</i>		.092	-.03	-.38	.708
<i>design</i>		.093	.207	2.214*	.033
<i>usefulness</i>		.113	.712	6.286*	.000
R-squared			.734		
Adjusted R-squared			.712		
Standard Error of the Estimate		.305			
F(3, 36)				33.06	.
task-orientation	<b>B</b>	<b>SE</b>	<b><math>\beta</math></b>	<b>t</b>	<b>p</b>
Constant	.747	.694		1.076	.289
<i>appropriateness</i>		.124	.06	.483	.632
<i>design</i>		.125	.314	2.506*	.017
<i>usefulness</i>		.152	.445	2.932*	.006
R-squared			.524		
Adjusted R-squared			.484		
Standard Error of the Estimate		.409			
F(3, 36)				13.2	.000
peer collaboration	<b>B</b>	<b>SE</b>	<b><math>\beta</math></b>	<b>t</b>	<b>p</b>
Constant	1.072	.88		1.218	.231
<i>appropriateness</i>		.157	.157	1	.324
<i>design</i>		.159	.538	3.386*	.002
<i>usefulness</i>		.193	.088	.454	.652
R-squared			.393		
Adjusted R-squared			.342		
Standard Error of the Estimate		.519			
F(3, 36)				7.77	.000
learning management	<b>B</b>	<b>SE</b>	<b><math>\beta</math></b>	<b>t</b>	<b>p</b>
Constant	.154	.717		.214	.832
<i>appropriateness</i>		.128	-.05	-.43	.67
<i>design</i>		.129	.673	5.197*	.000
<i>usefulness</i>		.157	.321	2.048*	.048
R-squared			.663		
Adjusted R-squared			.635		
Standard Error of the Estimate		.423			
F(3, 36)				23.58	.000
self-efficacy	<b>B</b>	<b>SE</b>	<b><math>\beta</math></b>	<b>t</b>	<b>p</b>
Constant	1.819	.533		3.414*	.002

<i>appropriateness</i>	.095	.331	3.487*	.001
<i>design</i>	.096	.069	.718	.478
<i>usefulness</i>	.117	.236	2.021	.051
R-squared		.42		
Adjusted R-squared		.371		
Standard Error of the Estimate	.314			
F(3, 36)			8.684	.000

\* $p < 0.05$

The table presents the results of analysis examining the effect of use of Earth and Life Science Innovation Supplementary Materials characteristics. The appropriateness, design and usefulness have significant effect on student's cognitive engagement. The F-test of the overall model is significant (F (4, 35) with,  $p < 0.05$ ), indicating that the regression model is a good fit for the data.

Ultimately, the significant effects demonstrate how important design and utility are to raising students' level of cognitive engagement with Earth and Life Science Innovative Supplementary Materials. Self-efficacy, task orientation, learning management, and information retention are all improved by well-designed, relevant, and effective materials. In order to enhance student learning and engagement in Earth and Life Science education, findings highlight how important it is to take these factors into account when creating and implementing supplemental materials.

#### 4. Conclusion and Recommendation

On the basis of the foregoing findings, the following conclusion was drawn.

The study showed the difference between the students' performance in diagnostic and summative test which indicated in the increase in the scores in performance in a statistically significant way. According to the results ( $p < 0.05$ .) implies that the students' academic achievement in Earth and Life Science is enhanced by the usage of innovative supplementary materials. As a result, the researcher concludes the rejection of the first hypothesis and comes to the conclusion that students' academic performance differs significantly when they use the Earth and Life Science Innovative Supplementary Materials.

Also, there is a significant effect seen in the level of cognitive engagement between students who were used the Earth and Life Science education and those who were used the instruction enhanced with Earth and Life Innovative supplementary materials. The result ( $p < 0.05$ ) revealed that components and characteristics of the supplementary materials were among the elements and features that significantly influenced students' level of cognitive engagement. In comparison to students who were used the traditional education alone, there is a statistically significant difference in the cognitive engagement level of students who were used Earth and Life Science education supplemented with Earth and Life Science Innovative supplementary materials. As a result, thus rejecting the second null hypothesis.

In conclusion, it showed that using Earth and Life Science Innovative Supplementary Materials improves students' academic performance and cognitive engagement. These results proved how useful and important it is to include supplemental materials in Earth and Life Science curricula in order to improve student learning outcomes and engagement.

Based on the drawn conclusions resulted to the following recommendations:

1. It is recommended that the school head serve as the foundation for building innovative instructional tools for students to reach their maximum potential, allowing teachers to fully supervise and evaluate the students.

2. The teachers may recommend and benefited from building and creating new educational strategies to assist students' performance. They require equal direction to succeed in school, and the factors influencing pupils' performance may also be beneficial to the teacher as bases in their daily lessons.

3. Inform the parents that their guidance has a significant impact on students' academic success in school. They are encouraged to actively participate in their children's educational journey, recognizing the crucial role they play in fostering a positive learning environment at home.

**Reference:**

Smith, A. (2019). Assessing the Content Validity of Supplementary Materials in Mathematics Education. Retrieved from:<https://www.mendeley.com/reference-manager/library/all-references/>