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Learning Materials in Fundamental Research on Science Students Class on Critical and Creative Disposition and Performance Output

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Abstract— *This study aimed to develop and validate a learning material on Fundamental Science Research in improving the Grade 7 STE-P Students' Creative and Critical Dispositions and Performance Output. The extent to which learning materials are assessed based on their components and features was the subject of this research. It also examines the level of students' critical and creative disposition and level of the students' performance in science research. Then, it analyzes the significant relationship on the level of learning materials and features on students' critical and creative disposition, as well as its significant effect on the students' performance output in science research. This study utilized a correlational research design. The researcher developed learning materials and survey questionnaires validated by experts. Quantitative data were collected from thirty-six (36) Grade 7 STE-P students of San Juan National High School using survey questionnaires. It was found out that the level of learning materials in references have a significant relationship in creative and critical disposition in terms of communication skills, writing skills, and problem-solving abilities, while the rest show no significant relationship. Furthermore, it is also found out that learning materials have no significant effect on students' research performance. These materials promoted knowledge acquisition, creativity and real-life application through strategic and research-based teaching approaches. Additionally, the components of learning materials in references have a significant relationship on some indicators of creative and critical disposition Therefore, the hypothesis is partially accepted. Also, the features of learning materials in differentiated learning and technology integration have significant relationship on some of the indicators of critical and creative dispositions. Thus, hypothesis is partially accepted. Furthermore, the learning materials show no significant effect on students' research performance. Thus, hypothesis is accepted. This indicates that the materials provided a strong foundation for research learning. However, factors such as strong communication and the use of varied, real-life-based teaching strategies should be encouraged. Drawing from the results, it is recommended that research teachers should improve science research performance and critical thinking through applying real-world tasks, collaboration, and mentorship. Learners are encouraged to engage in research activities beyond the provided learning materials activities beyond the classroom.*

Keywords— *Creative, Critical, Disposition, Performance, Research*.

I. INTRODUCTION

The Department of Education has consistently implemented various programs and projects aiming to unleash the full potential of the learners across various disciplines. In line with this mission, the Department of Education has been implementing the Science, Technology, and Engineering Program (STE-P), a flagship program for the development of Science, Mathematics, Engineering, and Research in Special Science Classes. As outlined in DepEd Order No. 41, s. 2004, the STE-P was designed to produce quality, highly responsible, morally upright, and nurturing, scientifically inclined learners through offering enhanced science and technology-oriented curricula as preparation for higher education and careers in STEM fields.

This program has been initiated to elevate access to high-quality secondary education, following a goal of developing learners who specifically aim for professionalism in the field of science, technology, and engineering. Currently, 112 schools have been implementing this program and have grown to include 86 public secondary schools nationwide. The Department of Education commits itself to assisting in developing and realizing the full potential of the students, particularly in Science and Mathematics.

The STE-P program aims to cater to the needs of the scientifically inclined learners, where they are provided with opportunities that will prepare them for higher education or a job that is strongly focused on Science, Mathematics, and Research through an Enhanced Science and Technology-Oriented Curriculum.

The Implementing Rules and Guidelines proposed by the Department of Education regarding Science, Technology, and Engineering Program (STE-P) stated that its core subjects shall follow the Learning Competencies in the K to 12 Curriculum and an additional Research subject. This advanced subject of the Special Program is the add-ons to the curriculum applying research in teaching and learning science, which are beneficial for learners as they track their course to become proficient in science, transforming science into more equitable and inclusive. (DepEd Order No. 31, s. 2012).

However, challenges such as inadequate learning resources, including learning materials and research tools, have hindered the program's full effectiveness. Lack of resources in the classroom, such as instructional materials, is considered a wicked problem. It could bring negative effects to both teachers and learners, which could also affect the parents of the children. It could possibly cause distress to both teachers and learners in the teaching and learning process. Moreover, learners could fail to learn to their fullest potential due to the unavailability of resources. (Maffea, 2020)

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The learning materials in fundamental science research played a significant role in guiding the learners during the teaching and learning process, enabling them to fundamentally inculcate topics under the science research curriculum through facilitating learning.

According to (Ordu, 2021), instructional materials are considered a tool developed to constantly assist teachers in transmitting, facilitating, and disseminating information and concepts towards learners within teaching and learning situations. Furthermore, the effectiveness of students' performance is enhanced by the use of instructional resources throughout the learning and teaching process.

The highest valued skills that the learners and professionals have are creative and critical thinking skills. Both critical and creative skills of the learners have to be developed in the instructional design, especially if we want to raise them to become possible young scientists in the future. We should always remember that learner and context analysis, organization of instructional objectives, development of instructional strategy, or assessment techniques become distinct in the instructional design step with regard to critical and creative thinking skills. (Auld, 2019)

The development of students' research skills has become increasingly important in the current context of science education. An efficient framework for teaching research within the science curriculum is becoming increasingly necessary. According to DepEd Order No.21, s. 2019, the Policy Guidelines on the K to 12 Basic Education Program explained that Research will be treated as a subject.

The utilization of learning materials is necessary as educators work to transmit critical research competencies to fill in the gaps in research education. The development process of the learning materials and their evaluation will be covered in detail in the ensuing sections of this research, which will also address the deficiencies in teaching Research.
The researcher aimed to improve the research performance of Grade 7 students participating in the Science, Technology, and Engineering Program (STE-P) by developing and utilizing a learning material designed to improve their creative and critical disposition in Science Research.

1.1 Statement of the Problem

Problem/s which were addressed by the research

The purpose of the study was to determine whether there is a significant relationship between the Learning Materials in fundamental research in science and their features to the students' critical and creative thinking skills and performance output of the Grade 7 STE-P using the learning materials designed to foster critical and creative disposition. Additionally, this study aimed to identify the learning gaps in teaching Research I among Grade 7 STE-P students.

Specifically, it sought the answers to the following questions.

1. What is the level of the assessment on the component of learning materials in fundamental research in terms of:
   1.1 Objectives;
   1.2 Introduction;
   1.3 Research Content;
   1.4 Learning Activity;
   1.5 Assessment and Evaluation; and
   1.6 Reference?
2. What is the level of the assessment on features of Learning Materials in fundamental research in terms of:
   2.1 Collaborative Opportunity;
   2.2 Differentiated Learning;
   2.3 Instructional Strategy; and
   2.4 Technology Integration?
3. What is the level of students' critical and creative disposition in terms of:
   3.1 Innovative Thinking;
   3.2 Communication Skills;
   3.3 Writing Skills;
   3.4 Analytical Skills;
   3.5 Problem-Solving Abilities; and
   3.6 Logical Reasoning?
4. What is the level of the students' performance in research in terms of performance output?
5. Is there a significant relationship between the level of learning materials in fundamental research on students' critical and creative dispositions?
6. Is there a significant effect of the level of learning materials on fundamental research and students' performance?

II. Methodology

This study utilized a correlational research design. The researcher developed learning materials and survey questionnaires validated by experts. Quantitative data were collected from thirty-six (36) Grade 7 STE-P students of San Juan National High School using survey questionnaires. The collected data will be analyzed using Paired t-tests to compare pre- and post-assessment results to determine if there are significant improvements in student performance, while Pearson Correlation was used to analyze the relationship of different features of the learning manual tool on students' performance and the skills under creative and critical dispositions. The data will be statistically computed, interpreted, and verbally analyzed.

III. Results and Discussion

This part presented the different results and discussed the results from treating the data gathered in this study. It presents the data gathered about the significant relationship between learning materials in fundamentals science research, its features and students' critical and creative disposition and performance output. In particular, the study sought to address the following:

Level of Component of Learning Materials in Fundamentals Research

In this study, the level of component of learning materials in fundamental science research refers to Objectives, Introduction, Research Content, Learning Activity, Assessment and Evaluation, and Reference.

From the viewpoint of the respondents, the tables below display the statement, average, standard deviation, comments, and verbal interpretation.

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Table 1 presents the level of component of learning materials in fundamentals research in terms of objectives.

The computed weighted mean of 4.28 with a standard deviation of 0.70 indicates a very high level of agreement among respondents regarding the clarity, alignment, and attainability of the objectives within the learning materials. This implies that the objectives provided are well structured, measurable, and effectively aligned with the content, ensuring that students can achieve the intended learning outcomes. The high ratings also indicate that the objectives cater to different levels of learning, cognitive, psychomotor, and affective, supporting a well-rounded approach to student development.

TABLE 1. Level of component of learning materials in fundamentals research in terms of Objectives

Statements	Mean	SD	Remarks
The objectives indicated per topic are clear, concise and specific for intended learning outcome.	4.47	0.56	Strongly Agree
The objectives are aligned specifically to the topic or content provided in the learning material.	4.28	0.74	Strongly Agree
The objectives are being measurable and clearly defined and suitable for assessment.	4.31	0.79	Strongly Agree
The objectives cater on the different levels of learning which are cognitive, psychomotor and affective domain.	4.11	0.67	Agree
The objectives are attainable within the allotted time frame of each topic.	4.25	0.69	Strongly Agree
Weighted Mean	4.28		
SD	0.70		
Verbal Interpretation	Very High		

These findings align with Chatterjee and Corral (2017), who emphasized that well-defined learning objectives guide students in focusing their learning efforts, ensuring that instructional goals are met efficiently. Their study highlighted that clear and measurable objectives enhance student engagement and comprehension, reinforcing the importance of structured learning materials in fostering meaningful academic progress.

Table 2 presents the level of component of learning materials in fundamentals research in terms of Introduction.

TABLE 2. Level of Assessments on the Component of Learning Materials in Fundamentals Research in Terms of Introduction

Statements	Mean	SD	Remarks
The introduction of each topic on learning materials captures interest and engage learners.	4.44	0.65	Strongly Agree
The introduction of each topic bridges the learner's prior knowledge and experiences.	4.56	0.61	Strongly Agree
The purpose of the lesson is clearly explained in the introduction of each lesson.	4.36	0.72	Strongly Agree
The introduction highlights and emphasize the main topics and concepts that will be covered.	4.33	0.68	Strongly Agree
The introduction of the lesson covers and aligns with the learning objectives and concepts of the learning material.	4.44	0.56	Strongly Agree
Weighted Mean	4.43		
SD	0.64		
Verbal Interpretation	Very High		

The computed weighted mean of 4.43 with a standard deviation of 0.64 indicates a very high level of agreement among respondents regarding the effectiveness of the introduction in engaging learners. This implies that the introduction of each topic effectively captures students' interest, bridges prior knowledge, and provides a clear overview of the lesson's purpose. Additionally, the results reveal that a well-structured introduction enhances comprehension by aligning learning objectives with the main topics and concepts covered in the lesson.

Table 3 presents the level of learning materials in Fundamentals of Research in terms of research content.

The computed weighted mean of 4.22 with a standard deviation of 0.66 reveals a very high level of agreement among respondents regarding the accuracy, organization, and clarity of the research content. The results indicate that the research content is well-structured, comprehensive, and appropriate for students' level of understanding. Additionally, the inclusion of meaningful real-life examples enhances learners' comprehension, ensuring that the content remains relevant and engaging.

TABLE 3. Level of Assessment on the Component of Learning Materials in Fundamentals Research in Terms of Research Content

Statements	Mean	SD	Remarks
The contents are aligned accurately and suitably for the student's level of understanding.	4.31	0.75	Strongly Agree
The contents are well-organized and comprehensive for easy understanding.	4.19	0.58	Agree
The contents, key concepts and terms being well-defined within the research content.	4.17	0.74	Agree
The research contents provide meaningful and real-life examples to aid the learners' comprehension.	4.30	0.62	Strongly Agree
The research contents are free from biases, errors, and irrelevant information.	4.14	0.64	Agree
Weighted Mean	4.22		
SD	0.66		
Verbal Interpretation	Very High		

These findings align with Hill and Jordan (2021), who emphasized that well-developed instructional materials contribute significantly to achieving learning outcomes that contains structured and student-friendly research content component and enable learners to acquire knowledge and skills effectively.

Table 4 presents the level of learning materials in Fundamentals of Research in terms of learning activity.

The computed weighted mean of 4.36 with a standard deviation of 0.68 reveals a very high level of agreement among respondents regarding the effectiveness of the learning activities. The results indicate that the learning activities are well-aligned with the lesson objectives, promote student engagement, and cater to different learning styles. Additionally, the inclusion of varied activities, such as individual tasks, group work, and hands-on exercises, ensures that learners remain motivated and actively involved in learning process.

These findings align with Özüdoğru (2022), differentiated instruction and well-structured learning activities in learning materials significantly enhance and encourage student engagement and academic achievement, and real-world activities.

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TABLE 4. Level of Assessment on the Component of Learning Materials in Fundamentals Research in Terms of Learning Activity

Statements	Mean	SD	Remarks
The learning activities are specifically aligned with the learning objectives and main content of the lesson.	4.25	0.65	Strongly Agree
The learning activities are promoting engagement, critical and creative thinking and collaboration.	4.39	0.77	Strongly Agree
The instructions are clear, detailed and easy to follow by the learners.	4.31	0.79	Strongly Agree
The learning activities caters to different learning (auditory, visual, kinesthetic) styles of the learners.	4.31	0.52	Strongly Agree
The learning activities have varied types of activity including individual, group, hands-on, discussion to maintain learners' interest.	4.56	0.65	Strongly Agree
Weighted Mean	4.36		
SD	0.68		
Verbal Interpretation	Very High		

Table 5 presents the level of learning materials in Fundamentals of Research in terms of assessment and evaluation.

The computed weighted mean of 4.38 with a standard deviation of 0.70 reveals a very high level of agreement among respondents regarding the alignment, clarity, and effectiveness of assessment questions. The results indicate that the assessments are well-structured, cater to Higher-Order Thinking Skills (HOTS), and effectively measure learners' understanding and abilities and reflects reliability and appropriateness of the assessment.

TABLE 5. Level of Assessment on the Component of Learning Materials in Fundamentals Research in Terms of Assessment and Evaluation

Statements	Mean	SD	Remarks
The assessment questions align with the learning objectives.	4.36	0.64	Strongly Agree
The assessment questions consist of questions that cater Higher-Order Thinking Skills (HOTS).	4.28	0.74	Strongly Agree
The assessment questions are being clear, relevant, and free of ambiguity.	4.28	0.70	Strongly Agree
The assessments questions can effectively measure the learners' understanding and abilities.	4.44	0.73	Strongly Agree
The assessment questions and choices are appropriate and reliable.	4.53	0.70	Strongly Agree
Weighted Mean	4.38		
SD	0.70		
Verbal Interpretation	Very High		

These findings align with (Kusurkar et al., 2023), who stated that well-designed assessments strategically guide students in focusing on essential learning outcomes. Effective assessment and evaluation in learning materials provide progress and reinforces critical thinking and problem-solving skills. Furthermore, from a strategic perspective, students may learn what to expect in assessments at the expense of what they need in real life. Therefore, a learning material must have assessment and evaluation to monitor progress.

Table 6 presents the level of learning materials in Fundamentals of Research in terms of references.

The computed weighted mean of 4.29 with a standard deviation of 0.75 reveals a very high level of agreement among respondents regarding the relevance, credibility, and appropriateness of the references used in the learning materials. The results indicate that the references are properly cited, follows the correct format, and aligned with the credibility of the content.

TABLE 6. Level of Assessments on the Component of Learning Materials in Fundamentals Research in Terms of Reference

Statements	Mean	SD	Remarks
The references are relevant, credible and appropriate for each topic.	4.25	0.77	Strongly Agree
The references follow current and up-to-date with the latest information.	4.28	0.66	Strongly Agree
The references are properly cited and indicated in the correct format.	4.44	0.73	Strongly Agree
The references support, strengthen and align in the credibility of the content of learning materials.	4.19	0.86	Agree
In the list of references, the additional resources or suggested readings provided can enhance the understanding of the learners.	4.30	0.75	Strongly Agree
Weighted Mean	4.29		
SD	0.75		
Verbal Interpretation	Very High		

Table 6 presents the level of component of learning materials in Fundamentals of Research in terms of Objectives, Introduction, Research Content, Learning Activity, Assessment and Evaluation, and Reference arrived at a grand mean score of 4.33 and a standard deviation of 0.69 and was verbally interpreted as very high among the respondents. This means that the components of learning materials in Fundamentals of Research are effectively designed and well-aligned with educational standards, ensuring clarity, engagement, and comprehensive learning.

Level of Features of Learning Materials in Fundamentals Research

In this study, the level of features of learning materials in fundamentals research refers to Collaborative Opportunity, Differentiated Learning, Instructional Strategy, and Technology Integration.

The statement, mean, standard deviation, remarks, and verbal interpretation from the respondents' points of view are presented in the tables below.

TABLE 7. Level of Assessment on the Features of Learning Materials in Fundamentals Research in Terms of Collaborative Opportunity

Statements	Mean	SD	Remarks
The learning material encourages group activities and discussions.	4.44	0.69	Strongly Agree
The material includes activities and drills that require teamwork and collaboration.	4.47	0.56	Strongly Agree
The material encourages equal participation and contributions within the group.	4.44	0.65	Strongly Agree
The material provides instructions or strategies for resolving problems and promoting collaboration during activities.	4.67	0.53	Strongly Agree
The material supports communication and sharing ideas among students to produce quality outputs.	4.61	0.55	Strongly Agree
Weighted Mean	4.53		
SD	0.60		
Verbal Interpretation	Very High		

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Table 7 presents the level of learning materials in Fundamentals of Research in terms of Collaborative Opportunity.

The computed weighted mean of 4.53 with a standard deviation of 0.60 reveals a very high level of agreement among respondents regarding the extent to which the learning materials foster collaboration. The results indicate that the materials effectively encourage teamwork, group discussions, and equal participation among students. Additionally, the inclusion of structured activities and strategies for promoting collaboration enhances students' ability to communicate, share ideas, and produce quality outputs.

These findings align with (Mckay & Sridharan, 2023), who emphasized that collaborative learning, an essential skill included in 21st century skills, has the capability to enhance the students' higher-order thinking including communication skills, writing skills, analytical thinking, logical thinking and engagement in academic tasks.

TABLE 8. Level of Assessment on the Features of Learning Materials in Fundamentals Research in Terms of Differentiated Learning

Statements	Mean	SD	Remarks
The learning material addresses the learners' diversity, needs including, preferences, and abilities.	4.47	0.65	Strongly Agree
The material provides differentiated activities to cater to different skill levels.	4.50	0.56	Strongly Agree
The materials incorporate visual, auditory, and kinesthetic learning methods.	4.22	0.68	Strongly Agree
The material includes clear instructions for learners who requires additional support or advanced tasks.	4.58	0.60	Strongly Agree
The learning material addresses the diversity of learners and their needs, preferences, and abilities.	4.42	0.65	Strongly Agree
Weighted Mean	4.44		
SD	0.64		
Verbal Interpretation	Very High		

Table 8 presents the level of learning materials in Fundamentals of Research in terms of Differentiated Learning.

The computed weighted mean of 4.44 with a standard deviation of 0.64 reveals a very high level of agreement among respondents regarding the extent to which the learning materials cater to diverse learning needs. The results indicate that the materials effectively address students' diversity in terms of preferences, abilities, and skill levels. Additionally, the materials incorporate various learning methods, such as visual, auditory, and kinesthetic approaches, while providing clear instructions to support learners.

These findings align with Özüdoğru (2022), who emphasized that differentiated instruction as one of the features in fostering academic achievement among students provides support for both struggling and advanced learners, differentiated learning opportunities create an inclusive and supportive learning environment.

Table 9 presents the level of learning materials in Fundamentals of Research in terms of Instructional Strategy.

The weighted average calculated to be 4.48 with a standard deviation of 0.63 shows a remarkable degree of consistency among respondents in terms of how well the teaching methods align with the learning goals. The results indicate that the materials effectively integrate inquiry-based, problem-solving, and experimental approaches, which enhance student engagement and promote higher-order thinking skills (HOTS) such as analysis, synthesis, and evaluation. Additionally, the clear, precise and easy-to-follow instructions contribute to students' level of understanding. Additionally, this allows learners to become a creative and critical thinker and enhance and propagate their way of grasping and inculcating the knowledge and different concepts thus, making their learning experiences more interactive and impactful and improve their lever of comprehension.

TABLE 9. Level of Assessment on the Features of Learning Materials in Fundamentals Research in Terms of Instructional Strategy

Statements	Mean	SD	Remarks
The learning material aligns with the learning objectives of critical and creative disposition.	4.44	0.69	Strongly Agree
The learning material, in general integrates inquiry-based, problem-solving, or experimental approaches.	4.39	0.73	Strongly Agree
The instructions and activities included in the learning material are clear and easy to follow and comprehend.	4.61	0.49	Strongly Agree
The learning activities and drills and practice provided in the material are engaging and interactive.	4.56	0.61	Strongly Agree
The learning activities promote higher-order thinking skills (HOTS) such as analysis, synthesis, and evaluation.	4.39	0.60	Strongly Agree
Weighted Mean	4.48		
SD	0.63		
Verbal Interpretation	Very High		

These findings align with Yang, (2017), who highlighted the importance of using multiple and effective instructional strategies, such as cooperative learning and problem-based learning used to engage students and promote critical and creative thinking skills are evidently essential to the learners. Learning materials in fundamentals of science research foster collaboration and higher-order thinking (HOTS), which can effectively enhance and inculcate the learning experience and the performance of the students in crafting science research. Additionally, the conclusion includes that using instructional practices through co-teaching and employing and implementing strategies like thematic units, collaboration among students, and peer tutoring for diverse students can be very effective in enhancing the student's level of critical and creative thinking skills.

Table 10 presents the level of features of learning materials in Fundamentals of Research in terms of Technology Integration.

The computed weighted mean of 4.46 with a standard deviation of 0.58 reveals a very high level of agreement among respondents regarding the integration of technology in the learning materials. The findings show that the materials successfully incorporate digital tools and platforms that improve learning abilities and foster the growth of critical and creative thinking. Additionally, the accessibility of technological components ensures that all students can benefit from these resources, while opportunities for showcasing learning outputs through multimedia or technology-based

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presentations further support the students' engagement and research skills.

TABLE 10. Level of Assessment on the Features of Learning Materials in Fundamental Research in Terms of Technology Integration

Statements	Mean	SD	Remarks
The learning materials include the utilization of digital tools, platforms, or learning resources to enhance learning skills.	4.39	0.55	Strongly Agree
The technological components of the learning material are accessible and suitable for all students.	4.44	0.65	Strongly Agree
The technological tools utilized in the learning material are appropriate for promoting research skills including creative and critical thinking skills.	4.56	0.50	Strongly Agree
The learning material facilitates students in utilization of technology ethically and responsibly for research purposes.	4.42	0.60	Strongly Agree
The learning material offers learning opportunities to showcase learning outputs using multimedia or technology-based presentations.	4.50	0.61	Strongly Agree
Weighted Mean	4.46		
SD	0.58		
Verbal Interpretation	Very High		

Level of Students' Critical and Creative Disposition

In this study, the level of students' critical and creative disposition refers to Innovative Thinking, Communication Skills, Writing Skills, Analytical Skills, Problem-Solving Abilities, and Logical Reasoning.

The statement, mean, standard deviation, comments, and verbal interpretation from the respondents' point of view are displayed in the tables below.

TABLE 11. Level of Students' Critical and Creative Disposition in Terms of Innovative Thinking

Statements	Mean	SD	Remarks
The learning materials definitely encouraged me to explore new ways of thinking about the content.	4.58	0.60	Strongly Agree
I learned to generate unique ideas while using this learning material.	4.39	0.73	Strongly Agree
The learning material helped me respond to a certain problem creatively.	4.31	0.58	Strongly Agree
This learning material motivated me to think beyond simple and conventional solutions.	4.33	0.59	Strongly Agree
I felt inspired to come up with new questions and respond with different creative insights related to the topic.	4.47	0.51	Strongly Agree
Weighted Mean	4.42		
SD	0.61		
Verbal Interpretation	Very High		

Table 11 presents the level of students' critical and creative disposition in terms of Innovative Thinking.

The computed weighted mean of 4.42 with a standard deviation of 0.61 reveals a very high level of agreement among respondents regarding the extent to which the learning materials foster innovative thinking. The results indicate that the materials effectively encourage students to explore new ways of thinking, generate unique ideas, and creatively solve problems. Additionally, the learning materials motivate students to think beyond conventional solutions and inspire them to ask new questions and offer creative insights on the topic.

These findings align with (Rahmawati et al., 2019), who emphasized that fostering innovative thinking in students is essential for enhancing their critical and creative abilities. Incorporating these types of activities and contents, specifically, innovative thinking as part of the learning materials can significantly contribute to the development of higher-order thinking skills, and has the ability to prepare students for more complex problem-solving tasks related to real-life situation.

TABLE 12. Level of Students' Critical and Creative Disposition in Terms of Communication Skills

Statements	Mean	SD	Remarks
The learning material improved my ability to explain furtherly and clearly my ideas to others.	4.33	0.68	Strongly Agree
I felt more confident discussing my ideas after using the learning material.	4.11	0.62	Agree
The learning material provided more opportunities to practice expressing my formulated ideas effectively.	4.53	0.61	Strongly Agree
I learned to actively listen and respond to others' ideas during group discussions.	4.44	0.69	Strongly Agree
This learning material helped me articulate my comprehension in both spoken and written form.	4.28	0.57	Strongly Agree
Weighted Mean	4.34		
SD	0.57		
Verbal Interpretation	Very High		

Table 12 presents the level of students' critical and creative disposition in terms of Communication Skills.

The computed weighted mean of 4.34 with a standard deviation of 0.57 reveals a very high level of agreement among respondents regarding the extent to which the learning materials enhance communication skills. The results indicate that the materials foster students' ability to express their ideas, practice effective communication, and engage in listening during group discussions.

These findings align with Wrahatnolo and Munoto (2018), who discussed the importance of fostering communication skills as part of the learning process. They emphasized that strong communication abilities enable students to engage in collaborative work, articulate their thoughts clearly, and enhance their problem-solving skills, contributing to overall academic success.

TABLE 13. Level of Students' Critical and Creative Disposition in Terms of Writing Skills

Statements	Mean	SD	Remarks
The learning material encouraged me to construct my thoughts logically in writing.	4.40	0.60	Strongly Agree
I furtherly learned to clearly explain complex ideas in writing after using this material.	4.42	0.50	Strongly Agree
My writing skills has improved as I worked through the exercises in the learning material.	4.44	0.65	Strongly Agree
My level of confidence has increased in writing about the topic after using the learning material.	4.14	0.64	Agree
This learning material helped me develop a clear and concise writing technique/style.	4.36	0.64	Strongly Agree
Weighted Mean	4.35		
SD	0.61		
Verbal Interpretation	Very High		

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Table 13 presents the level of students' critical and creative disposition in terms of Writing Skills.

The computed weighted mean of 4.35 with a standard deviation of 0.61 reveals a very high level of agreement among respondents regarding the impact of the learning materials on their writing abilities. The results show that the materials effectively encourage students to construct their thoughts logically, explain complex ideas clearly in writing, and improve their overall writing technique. Additionally, the learning materials increase students' confidence in expressing themselves through written forms.

These findings align with (Fatmawati et al., 2019), who emphasized the importance of providing students with opportunities to practice writing in various contexts. Well-designed learning materials can help students refine their writing skills, clarity, and precision, the essential skills for effective communication. Moreover, enhanced learning achievement could be acquired if these skills would be empowered their importance in scientific writing and research.

TABLE 14. Level of Students' Critical and Creative Disposition in Terms of Analytical Skills

Statements	Mean	SD	Remarks
The learning material helped me analyze and break down complex information into simple ones.	4.44	0.61	Strongly Agree
My ability has increased in terms of identifying key elements within the topic.	4.25	0.73	Strongly Agree
The learning material has developed my ability to evaluate information critically.	4.33	0.68	Strongly Agree
I furtherly learned to make logical connections between ideas while using this learning material.	4.50	0.56	Strongly Agree
This learning material taught me how to analyze, synthesize and respond to problems from multiple perspectives.	4.61	0.49	Strongly Agree
Weighted Mean	4.43		
SD	0.63		
Verbal Interpretation	Very High		

Table 14 presents the level of students' critical and creative disposition in terms of Analytical Skills. The computed weighted mean of 4.43 with a standard deviation of 0.63 indicates a very high level of agreement among respondents regarding the effectiveness of the learning materials in fostering their analytical skills. The results reveal that the learning materials are highly effective in helping students break down complex information, evaluate data critically, identify key elements, and make logical connections between ideas.

These findings align with Hill and Jordan (2021), who emphasized the importance of analytical skills in students' academic and real-world problem-solving abilities. Their research highlights that well-designed learning materials that engage students with complex ideas enhance their capacity to think critically and analytically, resulting in better learning outcomes. Additionally, this will lead to framework setup, maximizing effective and efficient learning especially that go beyond basic teaching methods including discovery-learning techniques can be powerful than presenting the facts.

Table 15 presents the level of students' critical and creative disposition in terms of Problem-Solving Abilities.

TABLE 15. Level of Students' Critical and Creative Disposition in Terms of Problem-Solving Abilities

Statements	Mean	SD	Remarks
I felt more confident in analyzing and solving problems related to the topic after using this learning material.	4.17	0.65	Agree
The learning material helped me to find effective solutions to complex questions.	4.31	0.67	Strongly Agree
This learning material helped me respond to problems analytically and strategically.	4.33	0.59	Strongly Agree
I enhanced skills in applying root cause analysis and resolving problems through this learning material.	4.28	0.61	Strongly Agree
The learning material encouraged me to assess different solutions before choosing the appropriate one.	4.36	0.59	Strongly Agree
Weighted Mean	4.29		
SD	0.62		
Verbal Interpretation	Very High		

The computed weighted mean of 4.29 with a standard deviation of 0.62 reveals a very high level of agreement among respondents, showing that the learning materials effectively fostered their problem-solving abilities. Students expressed increased confidence in analyzing and solving problems, with the materials encouraging them to assess multiple solutions before making decisions.

These findings align with (Qiang et al., 2018), who emphasized that problem-solving is developed through engaging learning activities. Incorporating structured problem-solving tasks, students enhance their analytical and critical thinking abilities, and engage in real-world activities. Additionally, scientific creativity, with creative self-concept acting as a mediator between the two positively are correlated with critical thinking and creative disposition.

TABLE 16. Level of Students' Critical and Creative Disposition in Terms of Logical Reasoning

Statements	Mean	SD	Remarks
The learning material helped me follow a logical process to end with conclusions.	4.28	0.70	Strongly Agree
I have enhanced my ability to identify cause-and-effect relationships within the contents.	4.47	0.51	Strongly Agree
This learning material improved my ability to make well-reasoned explanation/information.	4.50	0.51	Strongly Agree
I felt more skilled at utilizing evidence to support my ideas after using the learning material.	4.14	0.68	Agree
The learning material encouraged me to think systematically about complex ideas.	4.28	0.57	Strongly Agree
Weighted Mean	4.33		
SD	0.61		
Verbal Interpretation	Very High		

Table 16 presents the level of students' critical and creative disposition in terms of Logical Reasoning.

The computed weighted mean of 4.33 with a standard deviation of 0.61 reveals a very high level of agreement among respondents, indicating that the learning materials significantly contributed to their development of logical reasoning skills. Students reported an enhanced ability to follow a logical process, identify cause-and-effect

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relationships, and make well-reasoned explanations, with the materials fostering systematic thinking.

These findings align with Ding et al., (2024), who highlighted that the development of logical reasoning is crucial for students in analyzing information, crafting a quality science learning materials and constructing well-supported arguments.

Table 17 presents the level of students' performance in research in terms of performance output.

The computed weighted mean of 89.61 with a standard deviation of 1.540 reveals an outstanding level of performance among the respondents. The results show that all students (100%) achieved scores within the "Outstanding" range of 77-95, which reveals that all students met and exceeded the expected standards for the research performance output.

This reveals that the learning materials and instructional strategies employed were highly effective in supporting students to excel in their research tasks. The very high scores reflect the students' ability to apply research concepts and techniques, leading to exceptional performance in their outputs.

TABLE 17. Level of Students' Performance in Research in Terms of Performance Output

Score	Test		Descriptive Equivalent
	f	%	
77 - 95	36	100.00	Outstanding
58 - 76	0	0.00	Very Satisfactory
39 - 57	0	0.00	Satisfactory
20 - 38	0	0.00	Fairly Satisfactory
1 - 19	0	0.00	Did not meet Expectation
Total	100	100	
Weighted Mean	89.61		
SD	1.540		
Verbal Interpretation	Outstanding		

TABLE 18. Significant Relationship Between the Learning Materials in Fundamentals Research and the Students' Critical and Creative Disposition

Learning materials in fundamentals research		Students' critical and creative disposition					
		I T	C S	W S	A S	PSA	Logical Reag
Component							
Objectives	Pearson Correlation	0.0750	0.0393	0.0684	0.0817	-0.0987	0.0770
	Significance (2-Tailed)	0.182	0.612	0.485	0.1602	0.9608	0.6223
	N	35	35	35	35	35	35
	Analysis	Not Sig	Not Sig	Not Sig	Not Sig	Not Sig	Not Sig
Introduction	Pearson Correlation	0.0758	-0.0027	0.0130	0.0349	-0.0139	0-.0952
	Significance (2-Tailed)	0.9037	0.4014	0.4126	1.0000	0.1793	0.3632
	N	35	35	35	35	35	35
	Analysis	Not Sig	Not Sig	Not Sig	Not Sig	Not Sig	Not Sig
Research Content	Pearson Correlation	0.2584	0.1585	0.3485	0.2821	0.2350	0.3189
	Significance (2-Tailed)	0.5262	0.8261	0.9043	0.4538	0.4408	0.7472
	N	35	35	35	35	35	35
	Analysis	Not Sig	Not Sig	Not Sig	Not Sig	Not Sig	Not Sig
Learning Activity	Pearson Correlation	0.2553	0.2097	0.3840	0.1806	0.1942	0.2219
	Significance (2-Tailed)	0.6745	0.7044	0.7527	0.6156	0.3785	0.6462
	N	35	35	35	35	35	35
	Analysis	Not Sig	Not Sig	Not Sig	Not Sig	Not Sig	Not Sig
Assessment and Evaluation	Pearson Correlation	-0.0327	-0.2848	-0.0033	-0.0860	-0.1317	0.0031
	Significance (2-Tailed)	0.3170	0.7574	0.6301	0.2981	0.9664	0.7499
	N	35	35	35	35	35	35
	Analysis	Not Sig	Not Sig	Not Sig	Not Sig	Not Sig	Not Sig
Reference	Pearson Correlation	0.1169	0.0947	0.1276	-0.0441	0.0392	-0.1318
	Significance (2-Tailed)	0.2009	0.0569	0.0401	0.3069	0.0165	0.0599
	N	35	35	35	35	35	35
	Analysis	Not Sig	Sig	Sig	Not Sig	Sig	Not Sig
Features							
Collaborative Opportunity	Pearson Correlation	0.1651	0.1263	0.0810	0.2272	0.0803	-0.0334
	Significance (2-Tailed)	0.7907	0.2970	0.3110	0.8945	0.1159	0.2780
	N	35	35	35	35	35	35
	Analysis	Not Sig	Not Sig	Not Sig	Not Sig	Not Sig	Not Sig
Differentiated Learning	Pearson Correlation	0.1132	0.0824	0.1000	0.2040	0.1589	0.2513
	Significance (2-Tailed)	0.4827	0.1619	0.1448	0.5594	0.0419	0.0908
	N	35	35	35	35	35	35
	Analysis	Not Sig	Not Sig	Not Sig	Not Sig	Sig	Not Sig
Instructional Strategy	Pearson Correlation	-0.0728	0.1896	0.1304	0.0801	-0.0233	-0.0114
	Significance (2-Tailed)	0.6095	0.1602	0.1547	0.6931	0.0664	0.1524
	N	35	35	35	35	35	35
	Analysis	Not Sig	Not Sig	Not Sig	Not Sig	Not Sig	Not Sig
Technology Integration	Pearson Correlation	-0.0122	0.0824	0.1000	0.0240	-0.0233	-0.0114
	Significance (2-Tailed)	0.4025	0.1602	0.1447	0.5531	0.0414	0.0924
	N	35	35	35	35	35	35
	Analysis	Not Sig	Not Sig	Not Sig	Not Sig	Sig	Not Sig

These findings align with Lerillard et al., (2021), who emphasized that well-structured learning materials promote critical thinking and research skills, enabling students to achieve high-quality academic outputs.

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Test of Relationship between the learning materials in fundamentals research and the students' critical and creative disposition.

To test the significant relationship between the learning materials in fundamentals research and the students' critical and creative disposition in terms of Innovative Thinking, Communication Skills, Writing Skills, Analytical Skills, Problem-Solving Abilities, and Logical Reasoning they were treated statistically using Real Statistics Data Analysis Tools using the Pearson product moment correlation coefficient.

From the findings above, we can infer that at the 0.05 level of significance, the null hypothesis. The components of learning materials in fundamental research in reference has a significant relationship in critical and creative disposition in terms of communication skills, writing skills and problem-solving abilities. The features of learning materials in fundamental research in technology integration and differentiated learning have significant relationship in critical and creative disposition in terms of problem-solving abilities. Likewise, the other components and features show no significant relationship.

This implies that, despite the different components of learning materials, such as objectives, introduction, research content, learning activities, assessment and evaluation, and references, there is no substantial correlation with the development of students' critical and creative dispositions, including innovative thinking, communication skills, writing skills, analytical skills, problem-solving abilities, and logical reasoning. Consequently, the instructional strategies and materials used may need further refinement to better foster these essential skills in students.

This finding is supported by previous studies, such as Özüdoğru (2022), who emphasized that for learning materials to effectively enhance creative dispositions, they must be integrated with engaging and thought-provoking activities. Özüdoğru emphasized that simply providing content is not sufficient; rather, instructional methods that prompt students to apply knowledge in real-world contexts are key to fostering skills such as problem-solving and critical thinking. Thus, the results of this study indicates that the current learning materials and strategies may need to be revisited and adjusted to better engage students and stimulate the development of these critical and creative thinking skills.

Test of Effect on the Learning Materials in Fundamentals Research and the Students' Performance Output in Science

To test the significant effect between the learning materials in fundamentals research and the students' performance in research in terms of performance output they were treated statistically using Real Statistics Data Analysis Tools using the Regression Analysis.

This indicates that the learning materials did not have a notable effect on the students' performance in their research outputs.

The lack of a significant effect implies that factors beyond the materials themselves may have influenced student performance. It is possible that the materials, while designed to be comprehensive, were not sufficiently engaging or tailored to the specific needs of the students, preventing them from maximizing their potential. Additionally, the students' prior knowledge, motivation, and the teaching methods employed may have played a more pivotal role in shaping their performance. This also reveals that while well-designed materials are important, they must be integrated with effective teaching strategies and active learning practices to produce the desired outcomes in student research performance.

TABLE 19. Test of Effect on the Use of Learning Materials in Fundamental Measure and Student Performance Output in Science

Components of Learning Materials	Beta Coefficient	t-value	p-value
Objectives	-0.609	0.072	0.475
Introduction	0.412	0.407	0.686
Research Content	1.411	1.690	0.102
Learning Activity	1.139	1.169	0.252
Assessment and Evaluation	-0.983	-1.019	0.317
Reference	-0.025	-0.043	0.966
Features of Learning Materials			
Collaborative Opportunity	-0.331	-0.415	0.681
Differentiated Activity	0.005	0.004	0.996
Instructional Strategy	-0.974	-0.915	0.368
Technology Integration	0.529	0.464	0.646

This finding implies that the effectiveness of the learning materials might not be the sole factor influencing students' performance. Other elements, such as student engagement, prior knowledge, and instructional strategies, could have played a more substantial role. Studies by Özüdoğru (2022) emphasized that learning materials, while important, need to be aligned with student needs and actively integrated into instructional practices to achieve the desired educational outcomes. These findings align with the notion that the quality and usage of materials, rather than their mere presence, significantly affect learning performance.

IV. Conclusion and Recommendations

Based on the findings above, the following conclusions were drawn:

The majority of the indicators on the components and features of learning materials in Fundamental research show no significant relationship thus, the hypothesis is partially accepted. This indicates that while the materials provided a strong foundation for research learning, other factors such as instructional strategies, student motivation, and external academic support may have played a more significant role in determining research performance outcomes.

The learning materials in Fundamentals of Research have no significant effect on students' research performance. Therefore, the hypothesis is accepted. This indicates that while the materials provided a strong foundation for research learning, other factors such as instructional strategies, student motivation, and external academic support may have played a more significant role in determining research performance outcomes.

Addressing aiding the needs of the learners towards learning research require a balanced approach that establish strong communication, thinking, and research skills. Through utilizing various teaching strategies that significantly targets on learners' needs and connect those concepts to real-life practice, teachers can benefit students comprehend better in

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science research, think more clearly and creatively, and constantly apply what they learn in meaningful ways.

In the formulated conclusions from the findings, it was recommended that:

Teachers may implement instructional strategies that go beyond structured content, incorporating real-world applications, collaborative research activities, and guided mentorship to better support students' research performance.

Students may be encouraged to engage in research activities beyond the provided learning materials, such as participating in academic conferences, workshops, and peer discussions, to further develop their research competencies.

Future researchers may explore additional factors influencing students' critical and creative dispositions and research performance, such as teaching methodologies, learning environments, and external academic support, to determine more effective approaches in improving research education.

Future research should examine the impact of literacy development, problem-based learning, and research-driven tasks on critical thinking and engagement. Studying independent research, applied learning techniques, and differentiated instruction can provide insights into enhancing cognitive readiness and real-life application of knowledge, leading to more effective teaching strategies to improve the critical and creative dispositions of the learners.

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