

Reinforcing Students' Basic Mathematical Skills and Performance Through Interactive E-Worksheet Learning Materials

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Abstract—This study examined the effects of an interactive e-worksheet on Grade 7 students' mathematical skills and performance at Liceo de Pila during the 2025–2026 Formation Year. Specifically, it assessed the level of performance of the e-Worksheet in terms of its components (i.e., content, activities, assessment, and feedback), features (i.e., usability, interactivity, appropriateness, and time efficiency); the students' mathematical skills in terms of accuracy, problem solving, critical thinking, and reasoning and logic, along with their performance (i.e., scores in the third quarterly examination); and the significant effect of the e-Worksheet components and features on students' mathematical skills and performance. It employed a descriptive research design involving 124 Grade 7 students using a researcher-made questionnaire and test. The data were analyzed using mean, standard deviation, and multiple regression analysis at a 0.05 level of significance. Findings showed that respondents rated the e-Worksheet components and features highly. They also demonstrated very satisfactory mathematical skills across all areas, with accuracy rated highest and reasoning and logic lowest. Their performance in the third quarterly exam was also very satisfactory, with most students earning outstanding scores. Inferential results showed that neither the components nor the features of the e-Worksheet significantly affect students' mathematical skills or their performance in Mathematics, thus, failing to reject both the null hypothesis. The positive perception of the e-Worksheet's design and functionality did not necessarily translate into significant gains in mathematical skills. One of the reasons was the lack of competencies necessary to improve the students' mathematical skills. Additionally, students' performance in mathematics is influenced by various factors, including prior knowledge, study habits, motivation, teaching strategies, and parental support, which may have had a greater impact on their performance results than the e-Worksheet itself. Based on the conclusions, the following recommendations were made. Students are encouraged to actively engage with other e-Worksheets alongside other learning strategies to strengthen reasoning, logic, and problem-solving skills while teachers are advised to integrate e-Worksheets with inquiry-based teaching approaches, meaningful feedback, and scaffolding strategies to maximize learning outcomes. Future researchers may further explore other variables influencing mathematical performance and examine the long-term effects of digital learning materials through experimental and qualitative studies.

Keywords— Interactive e-worksheet, component, features, mathematical skills, performance.

I. INTRODUCTION

In recent years, education systems have increasingly integrated digital learning tools to enhance instructional

delivery and improve student learning outcomes. This shift is driven by rapid technological advancement, evolving learner needs, and the demand for more flexible and learner-centered approaches. In Mathematics education, tools such as e-Worksheets have become important resources that support both teaching and learning, particularly in developing essential skills such as problem-solving, critical thinking, and logical reasoning. According to the OECD (2019), mathematical literacy is crucial for preparing learners for real-life decision-making and problem-solving in a rapidly changing world, yet many students continue to struggle to master foundational mathematical concepts.

A key concern in Mathematics education is the mastery of basic concepts, particularly integers, which serve as a foundation for more complex topics. Strong foundational learning is essential across all fields and disciplines, as mastery of the basics enables progression to higher levels of performance. Yao Ydo (2022) emphasizes that strengthening foundational learning positively influences curriculum implementation and supports lifelong learning by equipping learners with essential competencies for academic, social, and professional development. Without a solid foundation, learners are more likely to encounter difficulties in advanced mathematical concepts. This principle of foundational learning is evident across developmental and academic stages.

For instance, a child who has not learned to crawl may struggle to walk, just as a learner who has not mastered phonics may struggle with reading. Similarly, students who have not developed fluency in basic operations, such as with integers, often experience difficulties in algebra and higher-level mathematics. These examples highlight that mastery of basic skills is a prerequisite for effective learning progression, reinforcing the need to strengthen foundational competencies through appropriate instructional tools such as e-Worksheets.

E-Worksheets are digital instructional materials designed to enhance learning through structured activities, interactivity, and immediate feedback. They promote active engagement and allow learners to work at their own pace while reinforcing key mathematical concepts. UNESCO (2021) notes that digital learning resources can improve accessibility, learner engagement, and autonomy when properly designed and implemented. In Mathematics, such tools are particularly useful in providing repetitive practice and guided learning experiences that support conceptual understanding.

Means et al. (2018) found that students in online and blended learning environments often outperform those in traditional settings, especially when interactive and structured learning materials are used. Similarly, Mayer (2021) explains that multimedia learning is most effective when instructional design follows principles that reduce cognitive overload and promote meaningful engagement, such as clarity, coherence, and learner control. Despite these advantages, the effectiveness of e-learning tools depends largely on their design and pedagogical integration. In this context, evaluating the skills, particularly integers, becomes essential in determining their true instructional value.

1.1 Statement of the Problem

Problem/s which were addressed by the research

This study aimed to find if the e-Worksheet learning material has a significant effect on the Mathematical skills of students.

Specifically, it aimed to answer the following questions:

1. What is the level of the following components of the e-Worksheet Learning Materials as perceived by the students:
 - 1.1 Content
 - 1.2 Activities
 - 1.3 Assessment, and
 - 1.4 Feedback?
 - 1.5 Usability
 - 1.6 Interactivity
 - 1.7 Appropriateness, and
 - 1.8 Time Efficiency?
2. What is the level of the students' basic mathematical skill in terms of:
 - 2.1 Accuracy
 - 2.2 Problem Solving
 - 2.3 Critical Thinking and
 - 2.4 Reasoning and Logic?
- 3rd What is the level of the students' performance in their quarterly examination?
4. Does the e-Worksheet learning material have a significant effect on the students' mathematical skills?
5. Does the e-Worksheet learning material have a significant effect on the students' performance?

II. METHODOLOGY

The study employed a descriptive research design involving 124 Grade 7 students using a researcher-made questionnaire and test. The data were analyzed using mean, standard deviation, and multiple regression analysis at a 0.05 level of significance.

III. RESULTS AND DISCUSSION

This part covers the presentation, analysis, and interpretation of data.

Interactive e-Worksheet Learning Materials in terms of Components

In this study, the term refers to the components present in the e-Worksheet learning materials. Specifically, this includes

content, activities, assessment, and feedback, which served as one of the independent variables.

The level of performance of the e-Worksheet learning material component, as perceived by the respondents, was analyzed statistically using mean and standard deviation.

Table 1 shows the level of the e-Worksheet learning material component in terms of content, as perceived by the students, including indicators, their corresponding means, standard deviations, and remarks.

The data from this study show that students' perceptions of the content component are consistently positive, as reflected in the weighted mean of 4.37 and standard deviation of 0.76, indicating a very high level of performance. This suggests that the e-Worksheet learning material effectively supports students' comprehension and learning needs.

The results revealed that the content of the e-Worksheet learning material is highly effective in facilitating students' understanding of mathematical concepts, particularly in integer operations. Specifically, the content is explained in a way that students can easily understand, supported by examples that enhance their learning, and aligned with what they learned in class. Moreover, students strongly agreed that the material covers important topics needed for studying integers and is easy to follow, indicating clarity, organization, and relevance of the content presented.

Table 1. Level of the Component of the e-Worksheet Learning Material in terms of Content.

Statements	MEAN	SD	REMARKS
The content of the e-Worksheet learning material is...			
...explained in a way I could understand.	4.40	0.76	Strongly Agree
...supported by examples that helped me learn integer operations better.	4.38	0.77	Strongly Agree
...accurate and matched what I learned in class.	4.21	0.74	Strongly Agree
...covering the important topics I needed to study about integers.	4.34	0.77	Strongly Agree
...easy to follow.	4.50	0.75	Strongly Agree
Weighted Mean	4.37		
SD	0.76		
Verbal Interpretation	Very High		

In summary, the findings imply that well-structured, clear, and example-supported content significantly enhances students' mathematical learning experience. The consistently high mean scores across all indicators suggest that the content component plays a crucial role in improving students' understanding and engagement in mathematics.

Table 2 shows the level of the e-Worksheet learning material component in terms of activities, as perceived by the students, including indicators, their corresponding means, standard deviations, and remarks.

The results revealed that the activities included in the e-Worksheet learning material are generally effective in supporting students' learning and engagement in mathematics. Specifically, students strongly agreed that the activities are helpful for practicing what they learned and sufficient for building their confidence in solving integer problems.

Table 2. Level of the Component of the e-Worksheet Learning Material in terms of Activities

Statements	MEAN	SD	REMARKS
The activities in the e-worksheet learning material are...			
...helpful in practicing what I learned.	4.32	0.67	Strongly Agree
...enough to make me feel confident in solving integer problems.	4.22	0.78	Strongly Agree
...making the topic more interesting to study.	4.08	0.87	Agree
...at the right level of difficulty for me.	4.27	0.77	Strongly Agree
...encouraging me to think and solve problems on my own.	4.19	0.78	Agree
Weighted Mean	4.22		
SD	0.78		
Verbal Interpretation	Very High		

They also perceived the activities to be at the right level of difficulty, indicating that the tasks are appropriately designed to match their capabilities. However, some indicators, such as making the topic more interesting to study and encouraging independent thinking and problem-solving, received slightly lower agreement, suggesting that while the activities are beneficial, there is still room to enhance their level of engagement and promotion of higher-order thinking skills.

The data from this study show that students' perceptions of the activities' components remain highly positive, as reflected in the weighted mean of 4.22 and a standard deviation of 0.78, indicating a very high level of performance. This implies that the activities in the e-Worksheet learning material effectively contribute to skill development and reinforcement of mathematical concepts.

In summary, the findings suggest that the activities component plays a significant role in strengthening students' practice and confidence in mathematics. While the consistently high ratings indicate effectiveness, slightly lower responses on engagement and independent thinking imply opportunities to further improve activities by making them more stimulating and cognitively challenging.

This aligns with the present study's findings, confirming that well-designed activities greatly help students understand concepts more effectively, making learning more engaging and enjoyable and thereby increasing students' learning capacity.

Table 3 shows the level of the e-Worksheet learning material component corresponding means, standard deviations, and remarks.

Table 3 shows the level of the e-Worksheet learning material component in terms of assessment, as perceived by the students, including indicators, their corresponding means, standard deviations, and remarks.

The results revealed that the assessment component of the e-Worksheet learning material is generally effective in evaluating students' learning and progress in mathematics. Specifically, students agreed that the assessments measure what they have actually learned, are aligned with the lessons and activities, and help them check their improvement after completing the tasks.

Table 3. Level of the Component of the e-Worksheet Learning Material in terms of Assessment

Statements	MEAN	SD	REMARKS
The assessment in the e-worksheet learning material is...			
...measuring what I actually learned.	4.11	0.77	Agree
...aligned to the lessons and activities.	4.16	0.71	Agree
...helping me check if I improved after taking the assessments.	4.06	0.89	Agree
...fair and not too difficult.	4.38	0.81	Strongly Agree
...helping me know my strengths and weaknesses in integers.	4.29	0.87	Strongly Agree
Weighted Mean	4.20		
SD	0.82		
Verbal Interpretation	High		

Furthermore, students strongly agreed that the assessments are fair and not too difficult, and that they are helpful in identifying their strengths and weaknesses in integer operations. These findings suggest that the assessments are appropriate, balanced, and useful for monitoring students' learning, although some aspects of measuring learning and tracking of the results may still be improved.

The data from this study show that students' perceptions of the assessment component are positive, as reflected in a weighted mean of 4.20 and a standard deviation of 0.82, indicating a high level of performance. This implies that the assessment component adequately supports the evaluation of students' mathematical skills and understanding.

In summary, the findings suggest that the assessment component effectively contributes to students' awareness of their performance in mathematics. While the overall ratings indicate that assessments are fair and informative, slightly lower responses on learning and improvement suggest a need for further refinement to strengthen their evaluative function.

Table 4 presents the level of the e-Worksheet learning material component in terms of feedback, as perceived by the students, including indicators, their corresponding means, standard deviations, and remarks.

The results revealed that the feedback provided in the interactive e-Worksheet learning material is generally effective in supporting students.

Table 4. Level of the Component of the e-Worksheet Learning Material in terms of Feedback

Statements	MEAN	SD	REMARKS
The feedback in the e-worksheet learning material is...			
...given immediately after answering.	4.10	0.86	Agree
...helping me know if my answers were correct or wrong.	4.03	0.97	Agree
...helping me improve my performance in solving similar problems.	3.99	1.05	Agree
...used to correct my mistakes.	4.09	0.97	Agree
...motivating me to keep trying even when I made mistakes.	3.90	0.99	Agree
Weighted Mean	4.02		
SD	0.97		
Verbal Interpretation	High		

Specifically, students agreed that feedback is given immediately after answering, helps them determine whether their responses are correct or incorrect, and is useful in

correcting their mistakes. Additionally, feedback was perceived as helping improve their performance in solving similar problems and motivating them to continue trying despite mistakes. However, these indicators consistently received “Agree” responses rather than “Strongly Agree,” suggesting that while feedback is present and beneficial, it may not be as impactful or engaging as learners expected.

The data from this study show that students’ perceptions of the feedback component remain positive, as reflected in a weighted mean of 4.02 and a standard deviation of 0.97, indicating a high level of performance. This implies that feedback in the e-Worksheet learning material plays a supportive role in learning, providing students with the necessary response for their answers, but may require further enhancement to maximize its effectiveness.

Interactive e-Worksheet Learning Material in terms of Features

In this study, the term refers to the features present in the e-Worksheet learning materials. Specifically, this included components such as the following; usability, interactivity, appropriateness, and time efficiency as independent variables.

The performance of the e-Worksheet learning material's features, as perceived by the respondents, was analyzed statistically using mean and standard deviation. These features were examined to determine the extent to which they contributed to creating an effective, engaging, and learner-centered.

Table 5. Level of the Features of the e-Worksheet Learning Material in terms of Usability

Statements	MEAN	SD	REMARKS
The e-Worksheet learning material is...			
... easy for me to use.	4.21	0.80	Strongly Agree
...allowing me to navigate without difficulty.	4.10	0.82	Agree
...supported by clear instructions on how to use it.	4.21	0.78	Strongly Agree
...working well on the device I used.	4.26	0.81	Strongly Agree
...making me feel comfortable using it on my own.	4.31	0.	Strongly Agree
Weighted Mean	4.22		
SD	0.81		
Verbal Interpretation	High		

Table 5 presents the level of the e-Worksheet learning material's features in terms of usability, as perceived by the students, including indicators, their corresponding means, standard deviations, and remarks.

The results revealed that the e-Worksheet learning material is generally user-friendly and accessible to students. Specifically, students strongly agreed that the material is easy to use, supported by clear instructions, works well on the device they used, and allows them to feel comfortable using it independently.

These findings suggest that the design and structure of the e-Worksheet promote ease of use and learner autonomy. However, the indicator for navigation received slightly lower agreement, suggesting that while students can still navigate the

material, there may be minor challenges in smoothly moving through its features. The data from this study shows that students’ perceptions of the usability of the e-Worksheet learning material are positive, as reflected in the weighted mean of 4.22 and standard deviation of 0.81, indicating a high level of performance. This implies that the material's usability features effectively support students’ interaction with the learning tool.

In summary, the findings suggest that the usability of the e-Worksheet learning material contributes significantly to students’ independent learning and overall experience, but slight improvements in navigation could further enhance the ease and efficiency of using the material.

Table 6 presents the level of the e-Worksheet learning material's features in terms of interactivity, as perceived by the students, along with indicators, their corresponding means, standard deviations, and remarks.

The results revealed that the e-Worksheet learning material demonstrates a satisfactory level of interactivity that supports students’ engagement in the learning process. Specifically, students agreed that the material allows them to actively participate in their learning, interact with activities such as typing, clicking, and dragging, and makes the lessons more engaging.

They also perceived that the interactive features help them better makes them feel more involved in learning, indicating that interactivity plays a key role in increasing their sense of participation. However, most indicators received “Agree” rather than “Strongly Agree,” suggesting that while the interactivity is effective, there is still potential to enhance its overall effectiveness.

Table 6. Level of the Features of the e-Worksheet Learning Material in terms of Interactivity

Statements	MEAN	SD	REMARKS
The e-Worksheet learning material is interactive in a way that...			
...allows me to actively participate in my learning.	4.12	0.81	Agree
...lets me interact with the activities (e.g., typing, clicking, dragging).	4.18	0.74	Agree
...makes the lesson more engaging for me.	4.15	0.88	Agree
...makes me feel more involved in learning.	4.32	0.77	Strongly Agree
...makes it easier for me to understand the topic.	4.05	0.88	Agree
Weighted Mean	4.16		
SD	0.82		
Verbal Interpretation	High		

The data from this study shows that students’ perceptions of the interactivity of the e-Worksheet learning material are positive, as reflected in the weighted mean of 4.16 and standard deviation of 0.82, indicating a high level of performance. This implies that the interactive features meaningfully contribute to students’ engagement and understanding, though further improvements could further strengthen their effectiveness.

In summary, the findings suggest that interactivity is an important feature that enhances students’ involvement and engagement in mathematics learning. While the overall ratings

indicate effectiveness, the slightly lower-level depth and variety of interactive elements in the e-Worksheet learning material.

Table 7 presents the level of the features of the e-Worksheet learning material in terms of appropriateness, as perceived by the students, along with indicators, their corresponding means, standard deviations, and remarks.

The results revealed that the e-Worksheet learning material is highly appropriate for the learners' academic level and learning needs. Specifically, students strongly agreed that the material is suitable for their grade level, that difficulty of the tasks matches their abilities.

Table 7. Level of the Features of the e-Worksheet Learning Material in terms of Appropriateness

Statements	MEAN	SD	REMARKS
The e-Worksheet learning material is appropriate in a way that...			
...it is suitable for my grade level.	4.23	0.71	Strongly Agree
...its content supports learning operations on integers.	4.29	0.65	Strongly Agree
...the difficulty of the tasks matches my ability.	4.27	0.76	Strongly Agree
...it is aligned with the topics discussed.	4.41	0.64	Strongly Agree
...it considers my learning pace and understanding.	4.22	0.80	Strongly Agree
Weighted Mean	4.28		
SD	0.71		
Verbal Interpretation	Very High		

They also strongly agreed that the e-Worksheet is well-aligned with the topics discussed in class and takes into account their individual learning pace and understanding. These findings suggest that the material is carefully designed to align with the curriculum requirements and students' cognitive levels, ensuring relevance and accessibility.

The data from this study shows that students' perceptions of the appropriateness of the e-Worksheet learning material are consistently positive, as reflected in the weighted mean of 4.28 and standard deviation of 0.71, indicating a very high level of performance.

This implies that the e-Worksheet is well-suited to the learners' needs and effectively supports their understanding of integer operations. In summary, the findings suggest that appropriateness is one of the strongest features of the indicators indicate that the material is well-aligned with the curriculum, developmentally appropriate, and responsive to students' learning capabilities.

Table 8 presents the level of the e-Worksheet learning material's features in terms of time efficiency, as perceived by the students, including indicators, their corresponding means, standard deviations, and remarks. The results revealed that the e-Worksheet learning material is generally effective in promoting efficient time use while learning mathematics.

Specifically, students strongly agreed that the e-Worksheet saves time compared to traditional paper worksheets, allows them to complete tasks efficiently without rushing, and helps them finish math activities within the given time. They also

agreed that the activities are not time-consuming but still support learning.

These findings indicate that the e-Worksheet learning material is tasks within appropriate time limits while still engaging with the content meaningfully.

Table 8. Level of the Features of the e-Worksheet Learning Material in terms of Time Efficiency

Statements	MEAN	SD	REMARKS
The e-Worksheet learning material is appropriate in a way that...			
... it saves time compared to traditional paper worksheets.	4.34	0.73	Strongly Agree
... the activities are not time consuming but still help me learn.	4.12	0.77	Agree
... it enables me to finish tasks efficiently without rushing.	4.31	0.80	Strongly Agree
... it helps me complete math activities within the given time.	4.36	0.80	Strongly Agree
... it helps me complete math activities within the given time.	4.24	0.96	Strongly Agree
Weighted Mean	4.28		
SD	0.82		
Verbal Interpretation	Very High		

The data from this study shows that students' perceptions of the time efficiency of the e-Worksheet learning material are consistently positive, as reflected in the weighted mean of 4.28 and standard deviation of 0.82, indicating a very high level of performance. This implies that the e-Worksheet effectively supports time management and efficient completion of learning tasks.

In summary, the findings suggest that time efficiency is a strong feature of the e-Worksheet learning material. The consistently high ratings indicate that it helps students manage their time effectively while learning mathematics, although slight improvements in making activities less time-consuming without reducing learning value may further enhance its effectiveness.

Students' Mathematical Skills

In this study, it refers to students' mathematical skills, measured by a test made by the researcher. It focuses on accuracy, problem solving, critical thinking, and reasoning and logic.

Table 9 shows the level of students' mathematical skills in terms of accuracy, including score ranges with their corresponding frequency, percentage, and descriptive equivalent. The results revealed that the majority of the students demonstrated a high level of accuracy in their mathematical skills.

Table 9. Level of Students' Mathematical Skills in terms of Accuracy

Scores	Frequency	Percentage	Descriptive Equivalent
9-10	71	57.26%	Outstanding
7-8	34	27.42%	Very Satisfactory
5-6	9	7.26%	Satisfactory
3-4	10	8.06%	Fairly Satisfactory
1-2	0	0.00%	Did Not Meet Expectation
Total	124	100%	

Specifically, 71 students, or 57.26%, obtained scores of 9–10, which are described as outstanding, indicating that more

than half of the respondents performed excellently in terms of accuracy. Additionally, 34 students, or 27.42%, achieved scores of 7–8, interpreted as very satisfactory, indicating that a considerable portion of the students also performed well. On the other hand, only a small number of students fell into the lower categories: 9 students (7.26%) were rated satisfactory, and 10 (8.06%) were rated fairly satisfactory. Notably, no student fell into the “did not meet expectation” category, indicating that all students demonstrated at least a basic level of accuracy.

The data from this study show that students' overall accuracy is high, as reflected in a weighted mean of 8.20 and a standard deviation of 1.95. This suggests that while most students performed at a high level, there is still some variability in their scores.

In summary, the findings suggest that students generally demonstrate strong accuracy in their mathematical skills, with the majority achieving outstanding or very satisfactory levels. This indicates that the students have a solid grasp of mathematical concepts, although a small proportion may still require additional support to further improve their performance.

Table 10. Level of Students' Mathematical Skills in terms of Problem Solving

Scores	Frequency	Percentage	Descriptive Equivalent
9-10	64	51.61	Outstanding
7-8	41	33.06	Very Satisfactory
5-6	14	11.29	Satisfactory
3-4	5	4.03	Fairly Satisfactory
1-2	0	0.00%	Did Not Meet Expectation
Total	124	100%	

Weighted Mean =8.13
SD=1.80

Table 10 shows the level of students' mathematical skills in problem-solving, including the score ranges, their corresponding frequencies, percentages, and descriptive equivalents.

The results revealed that most students demonstrated high problem-solving skills. Specifically, 64 students (51.61%) obtained scores of 9–10, which is described as outstanding, indicating that more than half of the respondents performed excellently in solving mathematical problems. Additionally, 41 students, or 33.06%, achieved scores of 7–8, interpreted as very satisfactory, indicating that a large proportion of students also possess strong problem-solving abilities. Meanwhile, 14 students or 11.29% were rated satisfactory, and only 5 students or 4.03% fell under fairly satisfactory, indicating that a small number of students experienced some difficulty in solving problems. Notably, no student was categorized under “did not meet expectation,” suggesting that all students demonstrated at least a basic level of problem-solving skill.

The data from this study show that students' overall problem-solving performance is high, as reflected in a weighted mean of 8.13 and a standard deviation of 1.80. This indicates that while most students performed at a high level, there is still some variation in their abilities.

In summary, the findings imply that students generally exhibit strong problem-solving skills in mathematics, with the majority achieving outstanding and very satisfactory levels.

However, a small proportion of students may still need additional support to further develop their problem-solving abilities.

Table 11 shows the level of students' mathematical skills in critical thinking, including the score ranges, their corresponding frequencies, percentages, and descriptive equivalents.

The results revealed that most students demonstrated a high level of critical thinking skills. Specifically, 64 students, or 50.81%, obtained scores of respondents performed excellently in analyzing and evaluating mathematical concepts. Additionally, 43 students or 34.68% achieved scores of 7–8, interpreted as very satisfactory, showing that a significant number of students also possess strong critical thinking abilities.

Table 11. Level of Students' Mathematical Skills in terms of Critical Thinking

Scores	Frequency	Percentage	Descriptive Equivalent
9-10	64	50.81%	Outstanding
7-8	43	34.68%	Very Satisfactory
5-6	16	12.90%	Satisfactory
3-4	2	1.61%	Fairly Satisfactory
1-2	0	0.00%	Did Not Meet Expectation
Total	124	100%	

Weighted Mean =8.02
SD=1.92

Meanwhile, 16 students or 12.90% were rated satisfactory, and only 2 students or 1.61% fell under fairly satisfactory, indicating that very few students experienced difficulty in this area. Notably, no student was categorized as “did not meet expectation,” suggesting that all students were able to demonstrate at least a basic level of critical thinking.

The data from this study show that students' overall critical thinking performance is high, as reflected in a weighted mean of 8.02 and a standard deviation of 1.92. This indicates that although most students performed at a high level, there is still some variability in their responses.

In summary, the findings imply that students generally exhibit strong critical thinking skills in mathematics, with the majority achieving outstanding and very satisfactory levels. However, a small proportion of students may still require further support to enhance their ability to analyze, evaluate, and apply mathematical concepts effectively.

Table 12. Level of Students' Mathematical Skills in terms of Reasoning and Logic

Scores	Frequency	Percentage	Descriptive Equivalent
9-10	49	39.52%	Outstanding
7-8	43	34.68%	Very Satisfactory
5-6	28	22.58%	Satisfactory
3-4	4	3.23%	Fairly Satisfactory
1-2	0	0.00%	Did Not Meet Expectation
Total	124	100%	

Weighted Mean =7.69
SD=1.49

Table 12 shows the level of students' mathematical skills in terms of reasoning and logic, including score ranges with their corresponding frequency, percentage, and descriptive equivalent. The results revealed that students generally

demonstrated a good level of reasoning and logical skills in mathematics.

Specifically, 49 students, or 39.52%, obtained scores of 9–10, which are described as outstanding, indicating that a considerable number of students performed excellently in reasoning and logical thinking. Additionally, 43 students, or 34.68%, achieved scores of 7–8, interpreted as very satisfactory, indicating that many students also possess strong reasoning abilities.

However, a notable portion of students, 28 or 22.58%, were rated satisfactory, and 4 students or 3.23% were fairly satisfactory, suggesting that some students experience challenges in applying logical reasoning in mathematical contexts. Nonetheless, no student fell under the “did not meet expectation” category, indicating that all students demonstrated at least a basic level of reasoning and logic skills.

The data from this study show that students' overall performance in reasoning and logic is high, as reflected in a weighted mean of 7.69 and a standard deviation of 1.49. This suggests that while students generally perform well, there is moderate variability in their reasoning abilities.

In summary, the findings imply that students possess satisfactory to high levels of reasoning and logical skills, with most achieving outstanding and very satisfactory ratings. However, compared to other mathematical skills, a larger proportion of students fall within the satisfactory range, indicating a need for additional support and instructional strategies to further strengthen their reasoning and logical thinking abilities.

In support of these findings, studies have shown that student worksheets and e-worksheets play a significant role in enhancing students' reasoning and critical thinking skills by engaging them in structured problem-solving and designed worksheet-based learning materials can effectively strengthen students' logical reasoning abilities, which aligns with the generally high level.

Students' Performance in Mathematics

In this study, it refers to students' mathematical performance, measured by a test made by the researcher. It focuses on students' performance in their third-quarter examination. The level of students' mathematical skills was treated statistically using the frequency and percentage.

Table 13. Level of Performance in Mathematics in terms of Third Quarterly Exam

Scores	Frequency	Percentage	Descriptive Equivalent
49-60	63	50.81%	Outstanding
37-48	28	22.5%	Very Satisfactory
25-36	30	24.19%	Satisfactory
13-24	2	1.61%	Fairly Satisfactory
1-12	1	0.81%	Did Not Meet Expectation
Total	124	100%	

Weighted Mean =47.92
SD=13.49

Table 13 shows students' performance in mathematics for the third quarterly exam, including score ranges, their

corresponding frequencies, percentages, and descriptive equivalents.

The results revealed that students generally performed at a high level in mathematics, with a considerable number achieving scores in the higher ranges. Specifically, 63 students, or 50.81%, obtained scores of 49–60, which is described as outstanding, indicating that half of the respondents performed excellently in the third quarterly examination. Additionally, 28 students or 22.50% achieved scores of 37–48, interpreted as very satisfactory, reflecting strong performance among a substantial portion of students. Meanwhile, 30 students, or 24.19%, were rated satisfactory, indicating that nearly a quarter of the students performed at an average level.

The data from this study shows that the overall performance of the students in the third quarterly examination are high, as reflected in the weighted mean of 47.92 and a standard deviation of 13.49. This suggests that while most students performed well, there is moderate variability in their examination scores.

In summary, the findings indicate that students generally perform well in mathematics, with the majority achieving outstanding or very satisfactory results. However, a notable proportion of students still fall within the satisfactory range, indicating the need for continued instructional support to further improve performance consistency.

Test of Effect of e-Worksheet Learning Material on the Students' Mathematical Skills

The significant effect of e-Worksheet learning materials on students' mathematical skills was statistically analyzed using Real Statistics Data Analysis Tools via multiple regression.

Table 14. Regression Analysis on the Effect of e-Worksheet Learning Material on the Students' Mathematical Skills

ANOVA^a

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	35.42	8	4.43	1.18	0.316
Residual	430.54	115	3.74		
Total	465.96	123			

a. Dependent Variable: Basic Mathematical Skills

b. Predictors: Components (Content, Activities, Assessment, Feedback), Features (Usability, Interactivity, Appropriateness, Time Efficiency)

Coefficients^a

Model	Unstandardized Coefficients			
	B	Std. Error	T	Sig.
(Constant)	6.14	2.81	2.19	0.031
Content	6.14	2.81	2.19	0.040
Activities	0.16	0.35	0.47	0.894
Assessment	0.05	0.38	0.13	0.043
Feedback	-0.69	0.34	-2.04	0.032
Usability	0.11	0.22	0.48	0.201
Interactivity	0.54	0.42	1.29	0.765
Appropriateness	0.11	0.36	0.30	0.368
Time Efficiency	0.48	0.53	0.90	0.423

For Table 14, a multiple regression analysis was conducted to determine whether the components and features of the e-

Worksheet learning material could significantly predict students' mathematical accuracy.

ANOVA was performed to evaluate whether the regression model was statistically significant; the results indicated that the overall model was not significant ($F(8,115) = 1.18, p > 0.05; p = 0.316$). Therefore, the combination of components and features in the e-Worksheet learning material did not make a significant contribution to predicting students' accuracy in mathematics. In other words, while these elements may support learning, they do not, taken together, significantly influence students' accuracy.

When examined individually, most components and features did not show a statistically significant association with students' accuracy. Content did not significantly predict Mathematical Skills ($B = 6.14, t = 2.19, p = 0.640$), indicating that although the material may be comprehensive, it does not directly influence students' Mathematical Skills scores.

Similarly, activities did not significantly predict Mathematical Skills ($B = 0.16, t = 0.47, p = 0.894$), suggesting that engaging in tasks alone may not be sufficient to improve precision in solving mathematical problems. Feedback also did not significantly predict Mathematical Skills ($B = -0.69, t = -2.04, p = 0.632$), suggesting that the feedback provided may not have a direct, measurable impact on students' answer correctness.

Among the predictors, only assessment showed a statistically significant effect on Mathematical Skills ($B = 0.05, t = 0.13, p = 0.043$), indicating that assessment-related features of the e Worksheet may have meaningful 0.48, $p = 0.201$), interactivity ($B = 0.54, t = 1.29, p = 0.765$), appropriateness ($B = 0.11, t = 0.30, p = 0.368$), and time efficiency ($B = 0.48, t = 0.90, p = 0.423$) were also found to be not statistically significant predictors of Mathematical Skills.

In summary, this implies that while the components and features of the e-Worksheet learning material contribute to the overall learning experience, they generally do not significantly affect students' Mathematical Skills. Only assessment demonstrated a significant influence, suggesting that how students are evaluated within the e-Worksheet may play a role in improving accuracy. Overall, this further suggests that other factors beyond the e-Worksheet itself, such as prior knowledge, study habits, or instructional support, may have a more substantial role in influencing students' Mathematical Skills.

Test of Effect of e-Worksheet Learning Material on the Students' Mathematical Performance

The significant effect of e-Worksheet learning materials on students' mathematical performance was statistically analyzed using Real Statistics Data Analysis Tools via multiple regression.

For Table 15, a multiple regression analysis was conducted to determine whether the components and features of the e-Worksheet learning material could significantly predict students' performance in mathematics.

ANOVA was performed to evaluate whether the regression model was significant ($F(8,115) = 0.32, p > 0.05; p = 0.956$).

Therefore, the combination of components and features in the e-Worksheet learning material did not make a significant contribution to predicting students' overall performance in mathematics. In other words, while these elements may support learning, they do not, taken together, significantly influence students' mathematical performance.

Table 15. Regression Analysis on the Effect of e-Worksheet Learning Material on the Students' Performance in Mathematics

ANOVA^a

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	492.31	8	61.54	0.32	0.956
Residual	21886.88	115	190.32		
Total	22379.19	123			

a. Dependent Variable: Performance in Mathematics

b. Predictors: Components (Content, Activities, Assessment, Feedback), Features (Usability, Interactivity, Appropriateness, Time Efficiency)

Coefficients^a

Model	Unstandardized Coefficients			
	B	Std. Error	T	Sig.
(Constant)	53.87	20.01	2.69	0.008
Content	-1.27	2.51	-0.51	0.613
Activities	0.73	2.74	0.27	0.789
Assessment	-2.19	2.40	-0.91	0.365
Feedback	1.09	1.58	0.69	0.489
Usability	1.63	3.00	0.54	0.587
Interactivity	0.83	2.56	0.32	0.747
Appropriateness	-1.17	3.81	-0.31	0.759
Time Efficiency	-0.94	2.51	-0.37	0.709

When examined individually, none of the components or features showed a statistically significant association with students' performance in mathematics. Content did not significantly predict performance ($B = -1.27, t = -0.51, p = 0.613$), indicating that the quality or clarity of the material does not directly influence students' overall scores. Similarly, activities did not significantly predict performance ($B = 0.73, t = 0.27, p = 0.789$), suggesting that engaging in tasks alone may not lead to improved academic outcomes.

Assessment also did not significantly predict performance ($B = -2.19, t = -0.91, p = 0.365$), implying that evaluation methods within the e-Worksheet may not directly affect students' achievement. Likewise, feedback did not significantly predict performance ($B = 1.09, t = 0.69, p = 0.489$), indicating that the feedback provided may not have a measurable impact on overall performance. Furthermore, usability ($B = 1.63, t = 0.54, p = 0.587$), interactivity ($B = 0.83, t = 0.32, p = 0.747$), appropriateness ($B = -1.17, t = -0.31, p = 0.759$), and time efficiency ($B = -0.94, t = -0.37, p = 0.709$) were all found to be not statistically significant predictors of students' performance in mathematics.

In summary, this implies that while the components and features of the e-Worksheet learning material contribute to the overall learning experience.

This implies that other factors beyond the e-Worksheet—such as prior knowledge, teaching strategies, student motivation, and learning environment—may play a more

substantial role in influencing students' achievement in mathematics.

IV. CONCLUSION AND RECOMMENDATIONS

Among the indicators of the e-Worksheet learning material, only assessment has a significant effect, while the other indicators, both components and features, did not significantly affect students' mathematical skills in terms of accuracy, problem solving, critical thinking, and reasoning and logic. Therefore, the first hypothesis failed to be rejected. This concludes that while these components are perceived positively, they do not independently or collectively have a measurable statistical effect on students' mathematical skill development. One possible explanation is that the e-Worksheet functioned primarily as a learning support tool rather than a skills-development intervention. While it provided opportunities for practice and engagement, the activities may have emphasized the completion of tasks rather than the cultivation of higher-order thinking processes required for problem solving, critical thinking, and logical reasoning which may not have been fully embedded within the e-Worksheet.

Furthermore, all of the indicators, both for components and features, of the e-Worksheet learning material posed no significant effect on students' rejected as well. This implies the effectiveness of e-Worksheets in improving performance may rely not only on the material itself but also on how it is implemented and supported in the learning process. The lack of a significant effect may also be due to the e-Worksheet activities focusing more on practice and content review than on higher-order skills such as problem-solving, critical thinking, and application. Additionally, students' mathematics performance is influenced by various factors, including prior knowledge, study habits, motivation, teaching strategies, and parental support, which may have had a greater impact on their examination results than the e-Worksheet itself.

Based on the findings and conclusions of the study, the following recommendations are offered:

Students may continue actively engaging with e-Worksheet activities and maximize its use as a supplementary learning tool. Although the results showed no direct statistical effect on mathematical skills, students can still benefit from its structured content and practice opportunities. They are encouraged to use the e-Worksheet alongside other learning strategies such as peer collaboration, self-study, and problem-solving practice to strengthen higher-order thinking skills, particularly reasoning and logic.

Teachers may integrate e-Worksheet learning materials with more inquiry-based and interactive teaching strategies.

Since the components and features alone were not significant predictors of performance, teacher facilitation remains essential. Teachers should also provide more meaningful and motivational feedback, guide students in interpreting errors, and design Enhancing classroom discussion and scaffolding strategies may help maximize the potential of the e-Worksheet.

Curriculum developers can further improve the design of the e-Worksheet materials by strengthening their interactive and adaptive features. Since interactivity and feedback were identified as weaker areas, future designs should incorporate more personalized learning paths, real-time feedback, and task variations that cater to different learner abilities. Alignment with higher-order thinking skills such as analysis, evaluation, and reasoning should also be emphasized to better support competency-based learning goals.

Parents and guardians may support learners by providing an environment conducive to studying and encouraging consistent use of e-Worksheet materials at home. Although digital tools are helpful, parental guidance and encouragement are crucial for sustaining students' motivation and discipline in mathematics learning. Monitoring study habits and reinforcing effort rather than just performance can also help improve student outcomes.

Future researchers can explore other variables that may influence mathematical performance, such as learning styles, teacher effectiveness, student motivation, and socio-economic factors. Future studies may also consider using experimental designs or longitudinal approaches to better determine the long-term effects of e-Worksheet integration. Additionally, qualitative studies may be conducted to gain deeper insights into students' experiences and challenges in using digital learning materials.

REFERENCE

- [1]. Mayer, R. E. (2021). *Multimedia learning* (3rd ed.). Cambridge University Press. <https://doi.org/10.1017/9781108894333>
- [2]. Means, B., Bakia, M., & Murphy, R. (2018). *Learning online: What research tells us about whether, when and how*. Routledge. <https://www.routledge.com/Learning-Online-What-Research-Tells-Us-About-Whether-When-and-How/Mean-Bakia-Murphy/p/book/9781138774200>
- [3]. OECD. (2019). *Trends shaping education 2019*. OECD Publishing. https://doi.org/10.1787/trends_edu-2019-en
- [4]. UNESCO. (2021). *Reimagining our futures together: A new social contract for education*. UNESCO Publishing. <https://unesdoc.unesco.org/ark:/48223/pf0000379707>
- [5]. Ydo, Y. (2022). *Building stronger foundations for learning: The key for effective curriculum implementation and lifelong learning*. Prospects, 52, 1–5. <https://doi.org/10.1007/s11125-022-09618-5>