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LEARNING COMPETENCY ACQUISITION, AND WORKSHEET USEFULNESS AND DIFFICULTY AS PREDICTORS OF STUDENTS' GEC MATHEMATICS PERFORMANCE

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ABSTRACT

Mathematics has been included in basic education programs to develop students' 21st-century skills and help them understand modern life. Teachers, however, face challenges teaching Mathematics in the Modern World (MMW) as a new course, making instructional materials vital for effective teaching. This study aims to measure the impact of instructional materials design on the students' performance in this sense. The research particularly focused on the acquisition of learning competencies, difficulties faced, and the usefulness of the worksheets as predictors of performance. A causal research design was used, with proportionate random sampling applied to select 258 students who took MMW during the second semester of the Academic Year 2021-2022.The findings revealed that students demonstrated high acquisition of knowledge, skills, and values. They rated the worksheets as moderately challenging but useful. Students with excellent or very good grades showed higher competency acquisition, followed by those with passing grades, and those with below-passing grades had the lowest competency levels. Pearson r correlation analysis indicated significant relationships between learning competency, difficulty, and usefulness with students' performance. However, regression analysis showed that only worksheet difficulty and usefulness were significant predictors of students' performance, suggesting a need for further review of these factors to improve outcomes.

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1. INTRODUCTION

Any educational organization strives to find ways to enhance the academic performance of its learners. One of which is the development of instructional materials. Studies have proven that students' performance in mathematics is strongly impacted by the quality of the educational materials (Tec, 2022; Saleh et al., 2022), hence signifies its importance to the learners' achievement. It also plays an important role, especially during pressing issues, such as the pandemic; it has been demonstrated that integrating interactive digital teaching material supports interactive mathematics learning and enhances students' mathematical thinking abilities (Delima et al., 2022). Various instructional materials, such as virtual tools and cooperative teaching methodologies, must be employed to improve student achievement and learning outcomes in college mathematics. How the instructional materials are designed and how learners perceive them in terms of their difficulty play a significant role in student achievement. It is noteworthy to see that how learners perceive they have acquired the intended learning competencies for a particular course contributes to their overall academic performance.

The redesigned Philippine educational system aspires to produce a holistically developed Filipino with 21st-century skills student through the K to 12 Enhanced Basic Education Program. In response to these needs and modifications, the Commission on Higher Education (CHED) issued the CMO No. 20 series 2013 as a guide that outlines the New General Education Curriculum (NGEC) in the context of K–12 curricula. General education is a section of the curriculum studied by all undergraduate students, regardless of major, in response to the challenges of the 21st Century. Mathematics in the Modern World is one of the general education courses that has been implemented. It is concerned with the nature of mathematics, the awareness of its practical, intellectual, and creative elements, and the use of mathematical instruments in everyday life. More precisely, MMW is expected to become a tool for coping with and grasping the complexities of modern living in terms of personal financial management, making social decisions, appreciating geometric designs, comprehending codes, and equitably distributing limited resources (CMO No. 20, series of 2013).

Teachers encounter extra challenges when transitioning from an old curriculum to a more complex one. Mathematics is considered one of the difficult subjects, as supported by the study of Asfari, et al. (2023), working memory plays a role in students' difficulties in learning mathematics. Teachers do not simply sit back and relax; instead, they strategize and plan how to teach the course so that students will comprehend it and attain the course competencies.

According to Afolabi et al. (2010), teaching can only be effective when adequate and relevant instructional materials are used. Instructional materials, such as textbooks, fact sheets, and video lectures, help the teaching and learning process become more operative. Accordingly, instructional materials are print and non-print items that convey information to students during the educational process. These are necessary tools for learning all subjects in the school curriculum. They let children interact with words, symbols, and ideas in ways that help them develop their communication and critical thinking skills (Bukoye, 2019).

Furthermore, using instructional materials is required in the teaching and learning process. They are crucial tools for improving any discipline's idea absorption, comprehension, application, and retention. Instructional materials make teaching and learning more meaningful and comprehensible to students (Obidile & Obi, 2020). These instructional materials are accompanied by activities that help students understand the concept better and assist them in dealing with the difficulties in each topic. According to Purwitaningrum (2021), a student worksheet is a printed instructional resource in the form of a paper sheet that contains information, summaries, and directions on implementing learning activities that students must complete, which relate to the essential competencies that must be attained.

This study was anchored to Roman and Villanueva's 2019 study, which results in both acquired competencies and difficulties strongly connected to students' performance in Mathematics in the Modern World; however, it differs in many aspects. Aside from the scope of the study, the instructional material developed by the institution is one of the variables being examined. More so, the learning competencies were based on the institution's syllabus.

The student's performance on learning outcomes provides feedback to improve the teaching and learning process and instructional materials (Munna, et al., 2021). Instructional material theories suggest a direct relationship between the resources teachers use and their pupils' learning outcomes. These benefits include improved learning capacities, excellent techniques for learning and performing classroom activities, and a favorable attitude toward learning. Furthermore, these theories assume that instructional materials can develop the highest order of intellectual skills in students by clearly demonstrating, step by step, how to follow the rules/principles and elaborate on the concepts, all of which have a positive impact on solving new problems by analyzing the situation and formulating a plan (Gagné et al., 2005). This study believes that by using instructional materials, students could understand the notion of the provided topic, allowing them to gain the needed competencies of a particular course.

Gagne et al. contend that instructional material may help learners achieve greater learning capacities through self-teaching or guided learning. This means that the instructional materials for guided discovery learning primarily consist of eliciting performance, offering feedback on performance accuracy, and giving learning direction. Most schools and colleges use synchronous and asynchronous learning modes in the new normal education system. Students are given more time to learn at their own pace using the resources provided.

Students acquired competencies demonstrate the course discipline's success in improving students' knowledge and their excellent values and valuable skills (Roman & Villanueva, 2019). This is a manifestation that students' level of competency acquisition in the course and their performance are related. They further posited that

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students who do not struggle with MMW perform well in the subject. Students who struggled with MMW also could have performed better in the topic. Thus, there is a relationship between the students' difficulty in answering the MMW worksheet and their performance in the said course. Lastly, the usage of instructional materials strengthens the relevance of education in an increasingly networked society, elevating the quality of education by making learning and teaching an active process connected to real-life experiences. (Evermeld, et al., 2023). Indeed, using instructional material contributes to the student's performance in any course.

The present study adds up to the body of knowledge as it tries to unveil the effects of the acquired learning competencies intended for the MMW course and the level of difficulties encountered the leaners during the curriculum implementation to their academic performance. As to the best of the researchers' knowledge there were no studies investigating the effects of such mentioned variables specific to the performance of MMW learners.

The Caraga State University main campus offered Mathematics in the Modern World to first-year students across all programs. The faculty of the Mathematics Department, College of Mathematics and Natural Sciences, developed an instructional material, a book, that will aid the teaching and learning process of the course. Given the cited literatures, the researchers studied the acquisition of expected learning competencies, the degree of difficulties, and the usefulness of the developed instructional material in Mathematics in the Modern World as predictors of the student's performance. Hence, the following problem statements:

1. What was the students' level of acquisition on the learning competencies intended for Mathematics in the Modern World?
2. What was the extent of difficulty experienced by the students in Mathematics in the Modern World in terms of answering the worksheets, and learning the topic?
3. What was the students' perceived level of usefulness of the instructional material in learning Mathematics in the Modern World?
4. What was the performance of the students in Mathematics in the Modern World?
5. Was the students' academic performance in Mathematics in the Modern World significantly correlate with their level of learning competency acquisition; difficulty in answering the worksheet; and usefulness of the worksheets as instructional material?
6. Did the students' academic performance in Mathematics in the Modern World significantly influence their level of learning competency acquisition; difficulty in answering the worksheet; and usefulness of worksheets as instructional material?

2. METHOD

Research Design

The study employed a causal research design where the variables were described, the relationships that naturally developed between and among them, and finally derived a regression model. This present study provides a quantitative description of the perceived level of learning competency acquisition, students' difficulty in answering MMW worksheets, and the usefulness of the worksheets as instructional material. Furthermore, the design indicated if the variables students' level of learning competency acquisition, difficulty in answering MMW worksheets, and usefulness of the worksheets as instructional material can be used to predict or influence students' performance in MMW.

Research Site and Sampling

The study was conducted at Caraga State University's main campus. It is a state-controlled university in Agusan del Norte, Philippines. Its main campus is in Ampayon, Butuan City, with an auxiliary campus in Cabadbaran City. It is a level 4 state university. The university has seven colleges, namely, the College of Humanities and Social Sciences, College of Mathematics and Natural Science, College of Computing and Information Sciences, College of Forestry and Environment Science, College of Education, College of Agriculture and Agri-Industries, and College of Engineering and Geosciences with 3, 8, 3, 3, 6, 5 and 5 programs offered respectively. This research used a proportionate stratified random sampling among those taking the Mathematics in the Modern World (MMW) course. The stratifications considered were the 15 MMW sections, with 16 to 18 students in each section being sampled; a computed sample size of 258 out of 791 comprised the sample.

Research Instruments

The study utilized a self-made instrument that contains three main parts. Part 1 collects the students' profile characteristics. The second part comprises the 9-indicator learning competencies where the students rated as Very Low (1), Low (2), Moderate (3), High (4), and Very High (5). This part measures the extent of the acquisition of Learning Competency. The indicators were derived from the syllabus that was anchored to the CMO No. 20, series of 2013, which the researcher secured through the consent of the subject coordinator of the University. The learning competency indicators have three main categories that include knowledge (with two indicators), skills (with five indicators), and values (with two indicators).

The Third part allows the students to rate the level of usefulness of the worksheets as well as its level of difficulty in answering them. The MMW instructional material has six chapters with a total of 33 worksheets. The University's instructional materials board approved the use of instructional material. The instrument underwent content validations, assessed by three experts, and rated with a mean of 5.00 (excellent) in terms of Presentation

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and Organization of Items, Attainment of Purpose, Objectivity, Scale and Evaluation Rating, and Adequateness of Items per Category or Indicator (mean=4.67, excellent). It was also rated with a mean of 4.33 (very good) in both Clarity of Directions and Item and Suitability of Items. Furthermore, the questionnaire was pilot-tested and obtained Cronbach's alpha of 0.948, which indicates high internal consistency and reliability. The last part of the instrument was the participants' consent to participate in the data gathering.

Research Participants
Table 1 displays the profile characteristics of the participants. More than half of them aged 18-19, dominated by non-STEM students, and mainly utilize cell phones for online learning. The primary source of internet connection is the use of Wi-Fi and Mobile Data.

Table 1.
Profile of the research participants

	f	%
Age (in years)		
18-19	133	51.55
20-21	106	41.09
22 and above	19	7.36
Learning strand (SHS)		
STEM	103	39.92
Non-STEM	155	60.08
Available learning gadgets		
Cellphone	238	92.25
Laptop and Desktop computers	120	48.45
Tablet	10	3.88
Smart television	10	3.88
Source of internet connection		
Mobile Data	162	62.79
Wifi	153	59.30
Peso Net	47	18.22

Data Analysis
The study used the mean, frequency counts, and percentages to describe the students' personal characteristics, acquisition level on the MMW learning competencies, and perceived level of usefulness and difficulty of the instructional material in learning MMW. Furthermore, Pearson r correlation was used in the study to assess if students' academic performance in MMW is significantly correlated with the level of learning competency acquisition, difficulty in answering the worksheet, and usefulness of the instructional material. Multiple linear regression was performed to measure the extent of influence of students' level of learning competency acquisition, difficulty in answering the worksheet, and usefulness of the instructional material to their performance in MMW.

3. RESULTS AND DISCUSSION

Students' MMW learning competency acquisition
The acquisition level of learning competencies intended for MMW among students is an essential indicator of their understanding of the underlying concepts in the course. When students have acquired the intended learning competencies, they have gained a firm grasp of its concepts. Table 2 shows the students' average level of acquisition of the learning competencies intended for MMW based on the three categories: knowledge, skills, and values.

Table 2.
Students' level of learning competency acquisition in MMW

Learning Competency	Mean	Verbal Description
Knowledge	**4.10**	**High**
Discuss the nature of mathematics, what it is, how it is expressed, represented, and used	4.12	High
Use different types of reasoning to justify statements and arguments made about mathematics and mathematical concepts	4.08	High
Skills	**4.20**	**High**

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Learning Competency	Mean	Verbal Description
Perform operations on Mathematical expressions correctly	4.17	High
Apply mathematics in other area such as graphs	4.22	High
Apply mathematics in other area such as finance	4.24	High
Apply mathematics in other area such as voting	4.27	High
Utilize a variety of statistical tools to process and manage numerical data	4.10	High
Values	**4.20**	**High**
Express appreciation for mathematics as a human endeavor	4.15	High
Affirm honesty and integrity in the application of mathematics to various human endeavors	4.20	High
Overall Mean	**4.17**	**High**

The table shows that students have high extent of learning acquisition in the knowledge category, with a mean of 4.10. These findings imply that students could describe the nature of mathematics, provide it with a real-world application, and analyze mathematical conventions after the competency was taught. This is supported by a 2019 study by Roman and Villanueva, which found that students could analyze texts, communicate effectively, employ fundamental MMW concepts, and apply this learning in the real world.

Moreover, students perceived that they have high level of acquisition on the learning competency on skills category with a mean of 4.20. This is a manifestation that after these competencies were taught, students could solve real-life situations using graphs, finance, and voting mathematics. Further, it implies that students demonstrated an ability to understand and manipulate numerical data using statistical tools. This finding is supported by the study by Roman and Villanueva (2019), which indicates that a strong acquisition of competencies under skills category may lead to improved critical thinking, analytical, and problem-solving abilities among students. For the learning competencies related to the values category, students also have a high level of learning competency acquisition with a mean of 4.20. This shows that students were not just focused on pure academic concepts of mathematics in the modern world but also the values; it signifies that after the lessons were taught, students confirmed truthfulness and integrity in using mathematics in many human pursuits. The importance of students' learning acquisition in mathematics extends beyond the classroom, as mathematics is a fundamental tool for problem-solving and decision-making in many real-world contexts. For example, a study by She et al. (2018) found that students with high levels of mathematics proficiency are more likely to succeed in higher education and their future careers. Licen et al. (2021) also emphasizes the importance of integrating knowledge, skills, and values to facilitate more meaningful learning.

Students' difficulty and usefulness of and in answering the worksheet

Research has shown that identifying difficult and easy worksheets is an important part of effective instructional design (McKeachie, 1994; Bieleke et al. 2023). By assessing students' perceptions of difficulty, teachers can identify areas of instruction that may require additional support or modifications. Table 3 shows the level of difficulty experienced by the students in answering the 34 developed worksheets in Mathematics in the Modern World

Table 3.
Level of difficulty experienced by the students in answering the worksheets in MMW

Lesson/Topic	Worksheet No.	Mean	Verbal Description
Chapter 1. Mathematics in Our World			
Patterns and Number in Nature	1.1.1	3.22	Neutral
	1.1.2	3.31	Neutral
Chapter 2. The Mathematical Language and Symbols			
Mathematics as Language	2.1.1	3.31	Neutral
	2.1.2	3.24	Neutral
Mathematical Logic	2.2.1	3.06	Neutral
	2.2.2	2.96	Neutral
Chapter 3. Problem Solving and Reasoning			
Mathematical Reasoning	3.1.1	3.10	Neutral
Problem Solving with Patterns	3.2.1	3.22	Neutral
	3.2.2	3.04	Neutral

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Lesson/Topic	Worksheet No.	Mean	Verbal Description
Polya's 4-Step of Problem Solving	3.3.1	2.98	Neutral
Chapter 4. Data Management			
Methods of Data Collection, Organization, and Presentation	4.1.1	2.98	Neutral
Some Basic Descriptive Measures	4.2.1	3.10	Neutral
	4.2.2	3.14	Neutral
Counting Techniques	4.3.1	3.08	Neutral
Introduction to Regression and Correlation Analyses	4.6.1	2.88	Neutral
	4.6.2	2.90	Neutral
	4.6.3	2.96	Neutral
Chapter 5. The Mathematics of Graphs			
Graphs	5.1.1	2.90	Neutral
Euler Path and Circuit	5.2.1	2.96	Neutral
	5.2.2	3.02	Neutral
	5.2.3	3.14	Neutral
Weighted Graphs	5.3.1a	3.06	Neutral
	5.3.1b	2.98	Neutral
	5.3.2a	3.02	Neutral
	5.3.2b	2.98	Neutral
	5.3.2c	2.92	Neutral
Hamiltonian Circuits	5.4.1	3.02	Neutral
Chapter 6. The Mathematics of Finance			
Simple and Compound Interest	6.1.1	2.86	Neutral
Stock Market Simulation	6.3.1	2.84	Neutral
Credit Cards: Wise Choice and Proper Management	6.4.1	2.98	Neutral
Credit Cards: Wise Choice and Proper Management	6.4.2	3.00	Neutral
Home Ownership	6.5.1	2.94	Neutral
	6.5.2	2.96	Neutral
	Over-all Mean	**3.03**	**Neutral**

Based on the results, the students perceived all the worksheets as moderately challenging, with an overall mean difficulty level of 3.03, which falls under the neither easy nor difficult–neutral category. This means that the students found the worksheets to be moderately challenging. This finding was supported by the study of Pekrun et al. (2009), which emphasizes that students who experienced a moderate level of challenge reported higher levels of enjoyment, interest, and self-efficacy than those who experienced low or high challenge levels. Similarly, Lu et al. (2023) found that students were more motivated to engage in moderately challenging activities than difficult ones. Olivia et al. (2022) also indicated that if students perceive worksheets as moderately challenging, it is likely beneficial, as it suggests an appropriate level of engagement and cognitive stimulation, fostering critical thinking skills and independent learning among students.

Worksheets are one way of assessing a student's knowledge of the topic; how one perceived it as difficult or easy indicates that one understands the concept. This claim is supported by the study of Esu, Enukoha, and Umoren (2004), which depicts those instructional materials such as activity sheets aid in the acquisition of abstract concepts by assisting in the concretization of ideas and stimulating learners' creativity. Table 4 shows the students' perceived level of usefulness of the faculty-developed instructional material in learning Mathematics in the Modern World.

The results show that the overall average mean is 4.34, which can be interpreted as useful. Therefore, the instructional materials are perceived as useful by the students. Understanding the factors that affect how students perceive an e-course's usefulness may be of considerable value for teachers and e-learning management when they are seeking to design an e-course that is more useful and helpful for students preparing for the final exam (Keržič et al., 2019). Additionally, instructional materials promote better academic performance (Edoho, Ebuara, Agbudu, & Inah, 2020; Galle, Agahu, & Riko, 2020).

Additionally, Motivating students through effective teaching practices with instructional materials demonstrates their crucial role in student success, while the absence of such materials may lead to a lack of motivation among students (Dufitumukiza et.al, 2023). The significance of effective instructional materials, particularly worksheets, in improving student learning outcomes is crucial. Research has shown that well-crafted

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worksheets play a significant role in supporting literacy acquisition, improving mathematics performance, and aiding in the teaching of scientific concepts (Iltavia et al., 2022; Emballa, 2022; Evans & Cleghorn, 2022). Therefore, the high perceived level of usefulness of the instructional materials in this table suggests that they may positively impact the student's motivation, engagement, and learning outcomes. Remarkably, even though the worksheets are helpful, students still found Mathematics in the Modern World topics difficult (as referred to in Table 3).

Table 4.
Students' perceived level of usefulness of the worksheet in learning MMW

Lesson/Topic	Worksheet No.	Mean	Verbal Description
Chapter 1. Mathematics in Our World			
Patterns and Number in Nature	1.1.1	4.37	Useful
	1.1.2	4.35	Useful
Chapter 2. The Mathematical Language and Symbols			
Mathematics as Language	2.1.1	4.35	Useful
	2.1.2	4.27	Useful
Mathematical Logic	2.2.1	4.37	Useful
	2.2.2	4.43	Useful
Chapter 3. Problem Solving and Reasoning			
Mathematical Reasoning	3.1.1	4.37	Useful
Problem Solving with Patterns	3.2.1	4.37	Useful
	3.2.2	4.33	Useful
Polya's 4-Step of Problem Solving	3.3.1	4.31	Useful
Chapter 4. Data Management			
Methods of Data Collection, Organization, and Presentation	4.1.1	4.33	Useful
Some Basic Descriptive Measures	4.2.1	4.37	Useful
	4.2.2	4.33	Useful
Counting Techniques	4.3.1	4.37	Useful
Introduction to Regression and Correlation Analyses	4.6.1	4.29	Useful
	4.6.2	4.31	Useful
	4.6.3	4.29	Useful
Chapter 5. The Mathematics of Graphs			
Graphs	5.1.1	4.33	Useful
Euler Path and Circuit	5.2.1	4.24	Useful
	5.2.2	4.37	Useful
	5.2.3	4.33	Useful
Weighted Graphs	5.3.1a	4.35	Useful
	5.3.1b	4.31	Useful
	5.3.2a	4.33	Useful
	5.3.2b	4.27	Useful
	5.3.2c	4.24	Useful
Hamiltonian Circuits	5.4.1	4.33	Useful
Chapter 6. The Mathematics of Finance			
Simple and Compound Interest	6.1.1	4.33	Useful
Stock Market Simulation	6.3.1	4.39	Useful
Credit Cards: Wise Choice and Proper Management	6.4.1	4.35	Useful
Credit Cards: Wise Choice and Proper Management	6.4.2	4.35	Useful
Home Ownership	6.5.1	4.43	Useful
	6.5.2	4.33	Useful
	Over-all Mean	**4.34**	**Useful**

Students' performance in Mathematics in the Modern World
Grades are one of the primary indicators used to determine whether or not students have learned the lesson, and teachers commonly use them to evaluate their teaching strategies and techniques and their students' academic performance. It serves as a quantitative measure of the knowledge and skills that students have acquired

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throughout the course, providing valuable feedback for both students and teachers. Through it, teachers can identify areas of strength and weakness in their teaching approaches and adjust their strategies accordingly to improve learning outcomes. Also, it can be used as a tool for students to evaluate their performance, identify improvement areas, and set goals for their future learning. Table 5 displays the students' grades in Mathematics in the Modern World, along with their level of learning competency acquisition, difficulty level, and the usefulness of the provided worksheet.

Table 5.
Students' performance in MMW across Learning Competency Acquisition, and Level of difficulty and usefulness of the worksheets

	Student Grades		
	1.00-1.75	**2.00-3.00**	**Below 3.00**
Frequency	57	167	34
Percentage	22.09	64.73	13.18
Learning competency acquisition level			
Mean	4.37 (High)	4.15 (High)	3.94 (High)
Min	2.89	2.00	2.00
Max	5.00	5.00	5.00
Difficulty in answering the worksheet			
Mean	3.32 (Neutral)	3.07 (Neutral)	2.92 (Neutral)
Min	1.91	1.04	1.55
Max	5.00	4.65	4.00
Usefulness of worksheet			
Mean	4.45 (Useful)	4.23 (Useful)	4.17 (Useful)
Min	3.86	3.00	3.03
Max	5.00	5.00	4.90

About 64.73% of students received passing grades (2.00 - 3.00), while 22.09% received excellent and very good grades (1.00 - 1.75), and 13.18% received below the passing grade. This distribution of grades aligns with previous studies that have found that most students tend to receive passing grades, with a smaller proportion of students receiving excellent or failing grades (Barber & King, 2019; Farooq et al., 2019).

Furthermore, students who received excellent and very good grades highly acquired the intended learning competency for MMW with a mean of 4.37, followed by those who received passing grades with a mean of 4.15. Meanwhile, students who received below passing grades had a mean learning competency acquisition of 3.94. This means that the student-respondents with higher grades also have a higher mean degree of learning competency acquisition. Similarly, a study by Striengana et al. (2019) indicates that higher grades are associated with greater learning competency acquisition, suggesting a positive link between academic performance and the development of competencies.

Students who received below passing grades found the course difficult, with a mean of 2.92, while those who received passing grades had a mean difficulty of 3.07. Students who received excellent and very good grades had a mean difficulty of 3.32. This indicates that the student-respondents who performed poorly in Mathematics in the Modern World found the course more difficult. Similarly, research by Garcia 2022, found that most topics covered in Mathematics in the Modern World were perceived as difficult by college sophomore students, despite their overall satisfactory performance. These findings are consistent with the study by Iddrisu et al. 2023, which highlighted that students' perceptions of mathematics as a difficult subject can negatively impact their academic performance in the course. Therefore, there is a clear indication that students who struggle with Mathematics in the Modern World tend to find the course more challenging, which affects their overall performance.

Moreover, the students rated the instructional materials as useful, with an average usefulness score of 4.45 for those who received excellent and very good grades, 4.23 for those who received passing grades, and 4.17 for those who received below passing grades. While this suggests that the instructional materials were useful in facilitating learning, it also highlights the need for further improvement in the design and delivery of instructional materials. Previous research has emphasized the importance of instructional design in promoting effective learning (Sweller et al., 2011). Moreover, the study by Terán and Nascimbene (2022) shows that students' perceptions of the usefulness and practicality of teaching materials are crucial for enhancing the learning experience. Research by Azi et al. (2022) also indicates that positive perceptions of instructional materials can significantly impact academic performance.

Predictors of student performance in MMW

Students' academic performance in Mathematics is one of the most important indicators of their overall educational achievement. It is affected by several factors, including the students' level of learning competency acquisition, the difficulty they experience in answering worksheets, and the usefulness of the instructional material.

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Understanding the relationship between these factors and academic performance can help educators develop effective teaching strategies and improve student's learning outcomes in Mathematics. Table 6 shows the relationship between the student's academic performance in Mathematics in the Modern World and their level of learning competency acquisition, difficulty in answering the worksheet, and usefulness of the instructional material.

Table 6.
Relationship between students' MMW performance across across learning competency acquisition, and difficulty and usefulness level of the worksheet

	Correlation	P-value*	Remark
Learning competency acquisition	-0.199	0.001	Significant
Difficulty in answering the worksheet	-0.202	0.001	Significant
Usefulness of worksheet as the instructional material	-0.162	0.009	Significant

**Tested at 0.05 level of significance using Pearson r*

The correlation coefficient for learning competency acquisition and academic performance in Mathematics in the Modern World is -0.199, which indicates a moderate negative correlation. In this case, a lower numerical value of academic performance indicates better grades (i.e., a grade of 1.00 is considered excellent, while a grade below three is considered failing). This finding is consistent with previous studies that demonstrated a positive impact of learning competency on academic achievement (Gómez-Molinero et al., 2019). Moreover, Competency-based college English classes have demonstrated a positive impact on both core competency and academic achievement, with learners enhancing their teamwork competency and subsequently achieving higher academic satisfaction (Hyekyung & SungAh 2022). Furthermore, e-learning, when combined with strong technical competency and effective e-learning standards, has been shown to positively influence student performance in various university settings (Saifali et al. 2022). These findings collectively underscore the significance of learning competency in promoting academic achievement across diverse educational contexts.

Moreover, the correlation coefficient for difficulty answering the worksheet and academic performance in Mathematics in the Modern World is -0.202, suggesting a moderate negative correlation. As the difficulty in answering the worksheet decreases, academic performance tends to increase.. So with, the study by Scasserra (2008) indicated that as the perceived difficulty of tasks decreased, task performance tended to increase, with participants demonstrating more successful responses on easier worksheets compared to harder ones.

Similarly, the correlation coefficient for the usefulness of instructional material and academic performance in Mathematics in the Modern World is -0.162, which indicates a weaker but still significant negative correlation. Students who do not find the instructional helpful material are likelier to perform poorly in Mathematics in the Modern World. The use of instructional materials promotes collaborative, active, and lifelong learning. It enhances student motivation, provides better access to information and shared resources, deepens understanding, and fosters creative thinking and communication skills. The use of instructional materials promotes collaborative, active, and lifelong learning. It enhances student motivation, provides better access to information and shared resources, deepens understanding, and fosters creative thinking and communication skills. Essentially, the use of instructional materials transforms the learning process in schools and contributes to improved academic performance (Evermeld et al., 2023). Furthermore, Pratiwi et al. (2022) highlighted that improvements in the learning environment, including the use of student worksheets, contributed to enhanced academic performance among students.

Nevertheless, it is important to note that a negative correlation does not necessarily indicates causation. However, the result suggests that learning competency acquisition, the difficulty experienced in answering the worksheets, and their usefulness were potential factors that could affect academic performance in Mathematics in the Modern World.

Table 7 displays the regression analysis summary on MMW academic performance in terms of the identified predictor variables – level of difficulty and usefulness of the worksheets. The final model in Table 7 provides the best model out of the candidate models.

Table 7.
Regression Analysis on academic performance in MMW across Level of difficulty and usefulness of the worksheets

Variable	Coefficients	*t*-Statistic	*P-value*	Remark
Intercept	4.947	7.744	<0.001	Significant
Difficulty in answering the worksheet	-0.328	-2.449	0.015	Significant

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Usefulness of the Worksheet	-0.325	-3.159	0.002	Significant

Note: *R Squared = 0.063, F(2,255)=8.452, p-value <0.001*

The regression model fits well with the data with p-value < 0.001 and R2= 0.063. The two independent variables – Difficulty in answering the worksheet and usefulness of the worksheet significantly influenced the academic performance in Mathematics in the Modern World with p-values of 0.015 and 0.002, respectively. Students who find the worksheet less difficult are expected to have high academic performance. The result is aligned with the findings of Al-Abdullatif, A. M., & Gameil, A. A. (2021), who investigated the relationship between task difficulty and academic performance. The authors found that students who perceived the worksheets as difficult achieved lower academic performance than those who perceived them as easier worksheets. Similarly, negative feedback discourages individuals with low achievement motivation more than those with high motivation. On the other hand, positive feedback strongly motivates individuals to take on challenging tasks, reducing differences in achievement motivation levels (Slapničar et.al., 2021). Additionally, the difficulty in answering worksheets and the usefulness of worksheets play a crucial role in influencing academic performance in Mathematics in the Modern World (Emballa, 2022)

Furthermore, the significance of instructional materials in enhancing students' academic performance has been established. This finding is consistent with the study conducted by Abubakar (2020), where the impact of instructional materials, mainly worksheets, on student learning outcomes was investigated. The findings revealed a clear advantage for students who had access to these materials in the learning process. The performance of students taught using worksheets showed remarkable improvement compared to those not provided with similar resources.

Overall, these recent findings support the statement that the difficulty and usefulness of the worksheet significantly influence academic performance. However, the R-squared value of 0.063 indicates that the two predictor variables in the model (difficulty in answering the worksheet and usefulness of worksheets) explain only 6.3 % of the variation in academic performance.

4. CONCLUSION

This study aimed to determine the predictors of students' performance in Mathematics in the Modern World, focusing on learning competency acquisition, worksheet usefulness, and difficulty. It evaluated the extent of learning competency acquisition, assessed the difficulty students experienced with worksheets, and determined the perceived usefulness of instructional materials. The study also examined the relationship between students' academic performance and these factors, and whether they significantly influenced students' performance in the course.

The study concludes that students achieved a high level of competency in knowledge, skills, and values in the Mathematics in the Modern World course. They grasped the course concepts well but found real-world application topics most challenging, despite finding worksheets only moderately challenging. Instructional materials were effective, as indicated by the students.

Most students passed the course, with higher grades linked to a higher degree of competency acquisition. However, only the difficulty and usefulness of worksheets were significant predictors of student performance. While effective instructional materials and competency acquisition impact performance, they are not the sole factors.

The study recommends reviewing and aligning learning materials and assessment tools with intended competencies. Providing additional examples and exercises of varying difficulty could help address challenges students face with worksheets and improve their problem-solving skills. Assessing the relevance of instructional materials to students' daily lives is advised to enhance motivation. Future research should explore other factors affecting academic performance, such as teaching strategies, student engagement, and motivation.

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