# Students' Competencies, Least Mastered Topics, and Performance in Mathematics in the Modern World

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## ABSTRACT

Students are expected to develop competencies in mathematics that integrate knowledge, skills, and values. Exhibiting these competencies in mathematics is one of the goals of mathematics education. Despite the efforts of the teachers to make students learn and acquire competence in the subject, difficulties are still encountered by the students. This descriptive-correlational research was conducted at Capiz State University during the Second Semester, School Year 2023-2024 to assess the level of acquired competencies, least mastered topics, and performance of first-year college students in Mathematics in the Modern World. Data were gathered using valid and reliable questionnaire, and were analyzed using descriptive and inferential statistics. Results of the study revealed that first-year college students generally had a high level of acquired competencies in terms of knowledge, skills, and values. However, there were topics identified as the least mastered topics namely, logic, sets, inductive and deductive reasoning, measures of dispersion, probability, and correlation. Students had an average level of performance in the subject. The acquired competencies by the respondents were significantly related to their performance. This implies that the higher the competencies acquired by the students, the higher the probability of getting high performance.

**Keywords:** knowledge, values, skills, least mastered topics, performance,

## INTRODUCTION

One of the general education subjects offered during the first semester in the college curriculum is Mathematics in the Modern World (MMW) with a 3-unit credit. Four mandatory topics in this subject are mathematics in our world, mathematical language and symbols, problem solving and reasoning, and data management, while two elective topics will be chosen depending to the need of the program to make a whole course (CMO 20, Series 2013).

The course is intended to make students appreciate the nature and uses of mathematics in everyday life. The competencies in MMW are not only focused on the cognitive aspect but also affective and psychomotor skills which are significant in the achievement of the intended learning outcomes of the MMW.

According to Cabral (2022), the topics in MMW are very useful to students in their daily lives and by studying the topics it would help them to go beyond the typical interpretation of mathematics as simply a bunch of formulas, but as a source of aesthetics in patterns of nature.

In the study of Roman (2019), students experienced difficulties on the different topics of MMW with satisfactory performance in the subject. In addition, Nabayra (2022), identified the least mastered topics in MMW and found that mathematics learning in the new normal is challenging and difficult.

During the pandemic, and even in times of crisis up to the present, asynchronous classes and modular learning have been widely implemented as alternative modes of instruction. In response, teachers were tasked to develop instructional materials in mathematics and other subject areas to ensure continuous learning. These materials are carefully designed to align with the students' level of understanding, providing ample exercises and activities that help learners acquire essential skills and knowledge from each lesson. Moreover, teachers

ensure that the objectives and learning outcomes of Mathematics in the Modern World (MMW) are effectively achieved through well-structured and student-centered instructional materials.

Despite the efforts of the teachers to make students learn and attain the competencies in the subject, challenges are still encountered by the students. The researcher believes that if students acquire the competencies intended for MMW, students can perform well in mathematics. Hence, this study.

The objective of the study was to determine the acquired competencies, least mastered topics and performance of students in Mathematics in the Modern World. Specifically, it sought answer to the following questions.

1. What is the level of competencies of the first-year college students in Mathematics in the Modern World (MMW) as an entire group, in terms of its dimensions namely knowledge, values, and skills, and when grouped according to sex and specialization?
2. What are the least mastered topics in Mathematics in the Modern World (MMW) by the respondents?
3. What is the respondents' level of performance in Mathematics in the Modern World?
4. Is there a significant relationship between competencies and performance in Mathematics in the Modern World (MMW) of the respondents?

**Null Hypothesis:**

1. There is no significant relationship between competencies and performance in Mathematics in the Modern World (MMW) of the respondents.

# METHODOLOGY

**Research Design and Participants**

This study employed a descriptive-correlational design to ascertain the relationship between the competencies and performance of first-year college students in the College of Education of Capiz State University during the Second Semester of School Year 2023-2024. The respondents of the study were selected through a simple random technique. Cochran's formula was used to determine the sample size using the criteria of 5% level of precision, a 95% confidence level, and 0.5 variability. Then, the sample size was proportionately distributed to different majors/specializations using the formula for allocation.

**Data Collection Tool**

The questionnaire was the primary instrument used in gathering data for this study. It was composed of three parts. Part 1 gathered information about the respondent's sex and major/specialization. Part II is a 5-point Likert scale comprising 23 item statements adopted from the study of Roman (2019) that would measure the competencies in math, namely knowledge, skills, and values. Part III is a 50-item multiple choice test adopted from the study of Nabayra (2022) that would cover the four mandatory topics in this subject, namely mathematics in our world, mathematical language and symbols, problem solving and reasoning, and data management.

The researcher acknowledges the constraints and weaknesses of the instrument, although these are standardized and adopted from other studies, and have been validated by experts. The competency data were based solely on self-assessment, which is susceptible to bias due to respondents inaccurately assessing their own abilities and may not accurately reflect their actual competency.

**Data Gathering Procedure**

Before administering the instrument, the researcher sought permission from the College Dean and the Campus Administrator. After the permit was approved, coordination was done with the program chair and advisers to administer the instrument to the students involved in the study. The researcher then personally administered the questionnaires to ensure a 100 percent retrieval. The data were consolidated and coded for statistical analysis.

## Statistical Analysis

Data were analyzed using both descriptive and inferential statistics. Descriptive statistics such as frequency count, percentage, mean, and standard deviation were utilized to describe the respondents' competencies, least mastered topics, and performance. For inferential analysis, Spearman's rho was used to determine the relationship between competencies and performance of the respondents. Results were interpreted at 0.05 level of significance.

# RESULTS AND DISCUSSION

## Profile of the Respondents

The majority of the respondents were female (87.27%). Most of them were enrolled in the BSED program with a specialization in English (20.9%), followed by Filipino (17.3%). A considerable number were from Social Studies and Science (12.7% each), while the smallest group came from BSED Mathematics (7.3%). Meanwhile, both the BEED and BPED programs had an equal number of respondents, each comprising 14.5% of the total.

## Level of Competencies of First Year College Students in Mathematics in the Modern World

Table 1 presents the level of competencies of the respondents. A majority of them were assessed to have a high level of competencies (60.91%), while one-third (33.64%) of them attained a very high level. Only a small proportion (5.45%) had an average level. The mean of 4.01 with a standard deviation of 0.41 indicates that, as a whole, respondents' competencies are generally at a high level. The result of the study negates with the findings of Gloria (2015) that students have low mathematical competence.

**Table 1.** Level of competencies of the respondents.

| Level | Frequency | Percent (%) |
|---|---|---|
| Very High | 37 | 33.64 |
| High | 67 | 60.91 |
| Average | 6 | 5.45 |
| Total | 110 | 100.00 |
| Mean=4.01, SD=0.41 (High) | | |

**Note:** Interpretation is based on the scale: 1.00-1.49 (Very Low), 1.50-2.49 (Low), 2.50-3.49 (Average), 3.50-4.49 (High), 4.50-5.0 (Very High)

Shown in Table 2 is the mean score per item-statement indicator on the three dimensions of competencies. In terms of knowledge, the respondents obtained a mean of 3.85, indicating a high level, with the highest rating on the ability to analyze text critically (M=4.25, Very High). For values, the mean was M=4.10 (High), highlighted by the very high ratings on taking responsibility for knowing and being Filipino (M=4.45) and respect for human rights (M=4.39). Meanwhile, under skills, the mean was 3.97 (High), with the highest rating on working effectively in a group (M=4.19, High). As a whole, these results suggest that respondents have acquired competencies at a high level across knowledge, values, and skills reaching a very high level. This result conformed with the findings of Roman (2019) that first-year college students have a high extent of acquisition of knowledge, values, and skills as set in the curriculum mapping of the Mathematics in the Modern World.

**Table 2.** Mean score per item statement-indicator on the three dimensions of competencies.

| Statement | Mean | SD | V.I. |
|---|---|---|---|
| **KNOWLEDGE** | | | |
| 1. I can analyze "texts" (written, visual, oral, etc) critically. | 4.25 | 0.59 | Very High |
| 2. I can demonstrate proficient and effective communication | 3.94 | 0.61 | High |

| | | | |
|---|---|---|---|
| (writing, speaking and use of new technologies) | | | |
| 3. I can use basic concepts across the domains of knowledge. | 3.91 | 0.61 | High |
| 4. I can demonstrate critical, analytical and creative writing. | 3.73 | 0.66 | High |
| 5. I can apply different analytical models in problem solving. | 3.43 | 0.70 | High |
| **Mean** | **3.85** | **0.48** | **High** |
| **VALUES** | | | |
| 6. I can appreciate the complexity of the human condition. | 4.22 | 0.60 | Very High |
| 7. I can interpret the human experience from various perspective. | 3.95 | 0.71 | High |
| 8. I can examine the purpose of communication from both Philippine and global perspectives. | 3.95 | 0.67 | High |
| 9. I can take responsibility for knowing and being Filipino. | 4.45 | 0.58 | Very High |
| 10. I can reflect critically on shared contents. | 3.95 | 0.63 | High |
| 11. I can generate innovative practices and solutions guided by ethical standards. | 3.87 | 0.59 | High |
| 12. I can make decisions based on moral norms and imperatives. | 4.05 | 0.60 | High |
| 13. I can appreciate various art forms. | 4.23 | 0.67 | Very High |
| 14. I can contribute to aesthetics. | 3.81 | 0.67 | High |
| 15. I can advocate respect for human rights. | 4.39 | 0.61 | Very High |
| 16. I can contribute personally and meaningfully to the country's development. | 4.18 | 0.61 | High |
| **Mean** | **4.10** | **0.41** | **High** |
| **SKILLS** | | | |
| 17.  I can work effectively in a group. | 4.19 | 0.60 | High |
| 18. I can apply computing tools to process information effectively. | 3.81 | 0.68 | High |
| 19. I can use current technology to assist and facilitate learning and research. | 4.14 | 0.71 | High |
| 20. I can negotiate the world of technology responsibly. | 3.82 | 0.73 | High |
| 21. I can create solutions to problems in various fields. | 3.78 | 0.70 | High |
| 22. I can manage one's knowledge skills and values for responsible and productive living. | 4.03 | 0.64 | High |
| 23. I can organize one's self of lifelong learning. | 4.05 | 0.71 | High |
| **Mean** | **3.97** | **0.50** | **High** |

**Note:** Interpretation is based on the scale: 1.00-1.49 (Very Low), 1.50-2.49 (Low), 2.50-3.49 (Average), 3.50-4.49 (High), 4.50-5.0 (Very High)

When the respondents were grouped according to profile variables (Table 3), in terms of sex, both male (M=3.94) and female respondents (M=4.02) had rated at a high level, with females obtaining a slightly higher mean. When classified according to specialization, the level of acquisition of the respondents ranged from a high (3.68) to a "very high" level (4.23). The highest competency levels were noted among BSED Social Studies (M=4.23, Ver High) and BSED Science (M=4.22, Very High). The BSED English (M=4.09) and BPED (M=4.04) groups also reflected high competency levels, while the BSED Filipino (M=3.68) and BSED Math (M=3.72) specializations had the lowest means, though still within the high category. Overall, the results indicate that respondents across sex and specialization generally demonstrated competencies at a high level, with notable strength in Social Studies and Science Specializations.

**Table 3.** Level of competencies of the respondent when grouped according to profile variables.

| Variables | Mean | Sd | V.I. |
|---|---|---|---|
| **Sex** | | | |
| Male | 3.94 | 0.38 | High |

| | | | |
|---|---|---|---|
| Female | 4.02 | 0.41 | High |
| **Specialization** | | | |
| BSED English | 4.09 | 0.31 | High |
| BSED Filipino | 3.68 | 0.42 | High |
| BSED Social Studies | 4.23 | 0.31 | Very High |
| BSED Science | 4.22 | 0.36 | Very High |
| BSED Math | 3.72 | 0.40 | High |
| BEED | 3.99 | 0.35 | High |
| BPED | 4.04 | 0.42 | High |

**Note:** Interpretation is based on the scale: 1.00-1.49 (Very Low), 1.50-2.49 (Low), 2.50-3.49 (Average), 3.50-4.49 (High), 4.50-5.0 (Very High)

**Least Mastered Topics in Mathematics in the Modern World**

Results show that there were seven (7) subtopics that were not mastered by the first-year college students, as seen in figures 1 to 4.

These subtopics were logic (15.45%), four basic concepts (sets, functions, relations, and binary operations) (35.64%) under Chapter 2-Mathematical Language and Symbols; inductive and deductive reasoning (11.87%) and recreational Problems using mathematics (33.64%) under Chapter 3-Problem Solving Reasoning; and measures of dispersion (15.00%), probability and normal distribution (18.18%), and linear regression and correlation (25.23%) under the Chapter 4 - Data Management.
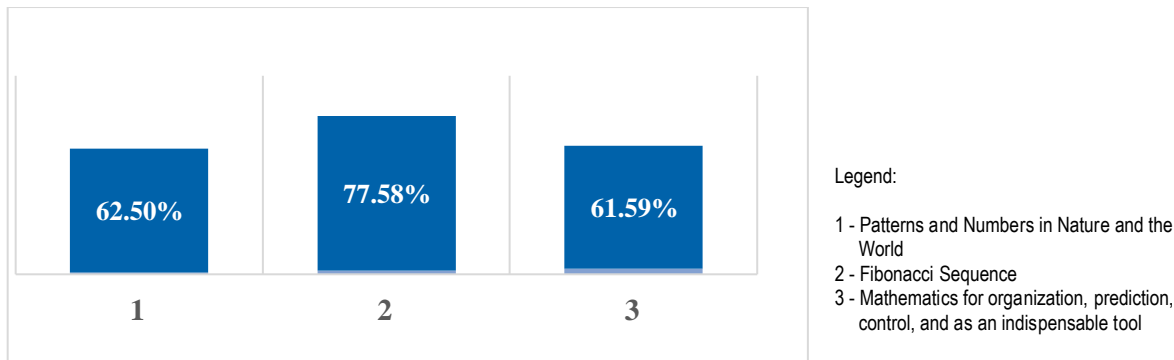
The least mastered topics were identified based on the mean percentage scores (MPS), calculated by dividing the number of students who answered the topic correctly by the total number of respondents, and then multiplying by 100.

The results imply that first-year students found these topics difficult, particularly in logic, reasoning, and data management. This suggests that teachers should strengthen discussions and provide additional activities on the least mastered topics to improve students' understanding. Likewise, implementing intervention programs such as remedial instruction, module enrichment, or contextualized learning strategies would help address these learning gaps.
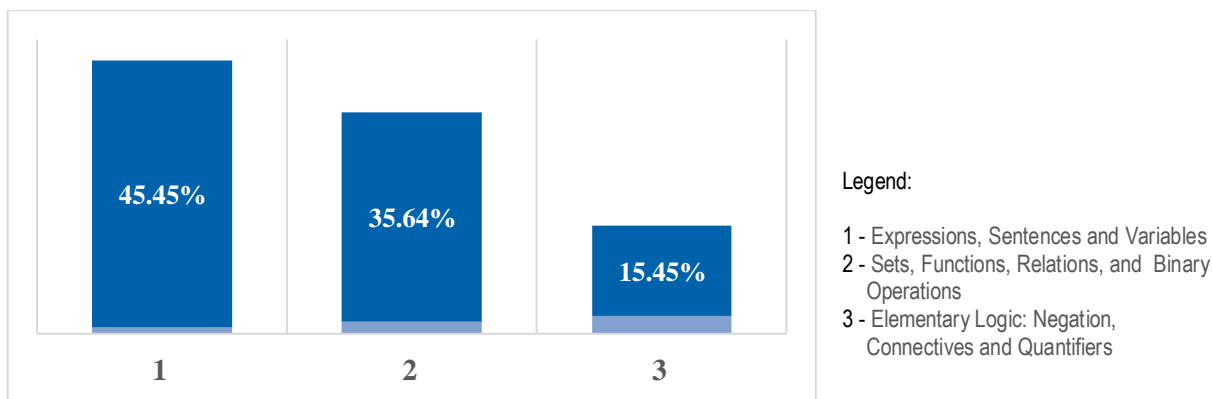
According to Barlovits, S., Jablonski, S., Lázaro, C., Ludwig, M., and Recio, T., (2021), the new normal learning environment may have also affected the results of the least mastered topics since it's difficult for the teachers to teach math concepts like statistics, problem solving, and logic in an online or even flexible learning environment which limited personal communication unlike in personal face-to-face interaction. In addition, it may also create key challenges for students, such as acquiring electronic devices for engagement, internet connectivity issues, electricity outages, and adapting teachers and students to this new mode of learning (The Gleaner, 2020).

Moreover, there is a need for teachers to incorporate 21st-century teaching tools, gadgets, and technology in teaching mathematics. Technology offers additional opportunities for students to engage with and explore mathematics concepts, fostering a positive attitude and perception toward the subject (Chand, S. et al. 2021)
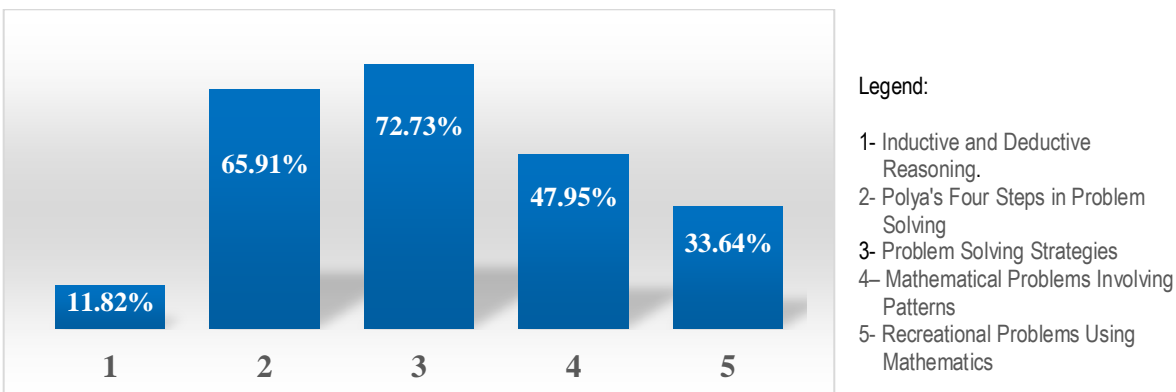
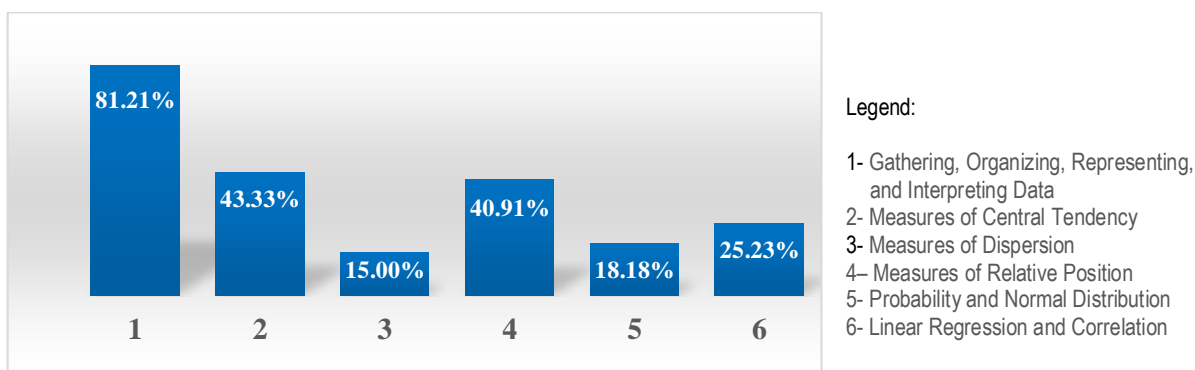**Figure 1.** Percentage of Correct Responses of Freshmen Students per Topic in Chapter 1 – "Mathematics in Our World"



Legend:

1 - Patterns and Numbers in Nature and the World
2 - Fibonacci Sequence
3 - Mathematics for organization, prediction, control, and as an indispensable tool

**Figure 2.** Percentage of Correct Responses of Freshmen Students per Topic in Chapter 2 – "Mathematical Language and Symbols"



Legend:

1 - Expressions, Sentences and Variables
2 - Sets, Functions, Relations, and Binary Operations
3 - Elementary Logic: Negation, Connectives and Quantifiers

**Figure 3.** Percentage of Correct Responses of Freshmen Students per Topic in Chapter 3 – "Problem Solving and Reasoning"



Legend:

1- Inductive and Deductive Reasoning.
2- Polya's Four Steps in Problem Solving
3- Problem Solving Strategies
4– Mathematical Problems Involving Patterns
5- Recreational Problems Using Mathematics

**Figure 4.** Percentage of Correct Responses of Freshmen Students per Topic in Chapter 4 – "Data Management"



Legend:

1- Gathering, Organizing, Representing, and Interpreting Data
2- Measures of Central Tendency
3- Measures of Dispersion
4– Measures of Relative Position
5- Probability and Normal Distribution
6- Linear Regression and Correlation

## Level of Performance in Mathematics in the Modern World

Data in Table 4 shows that the majority of the respondents (65.5%) had an average level of performance in MMW, thirty percent of them had a low level, while only a few (4.5%) reached a high level of performance. In general, the mean of 23.40 with a standard deviation of 5.12 indicates that students had average performance in math. It can be inferred that prior math exposure, attitude toward math, and other factors can influence math performance. This is consistent with the findings of Roman (2019), which reported a satisfactory performance among first year college students in Math in the Modern World. Furthermore, students demonstrate little mastery of essential mathematical concepts, indicating a need for preparatory programs to enhance their proficiency and performance in advanced mathematics courses (Santos et al., 2022).

**Table 4.** Level of performance in MMW

| Level | Freq | Percent (%) |
|---|---|---|
| High | 5 | 4.5 |
| Average | 72 | 65.5 |
| Low | 33 | 30.0 |
| Total | 110 | 100.0 |
| M=23.40, SD=5.12 (Average) | | |

## Relationship between competencies and performance in MMW by the respondents

Table 5 reflects the relationship between competencies by the respondents and their performance in MMW. As disclosed, the r-value of 0.264 with the probability value of 0.005 is lesser than 0.05 alpha. This indicates a significant positive correlation between the two variables, though the correlation is weak. A positive r-value suggests that an increase in one variable is generally associated with an increase in the other, but only to a small extent. Key factors, such as students' prior math knowledge, their interest, and foundational skills, likely contribute to stronger math performance. Instructional quality and access to learning resources can also play crucial roles by supporting these mediating variables and further enhancing performance. Since the p-value is statistically significant, the null hypothesis stating that there is no significant correlation between the students' competencies and performance is rejected. These findings suggest that when students acquire essential competencies in mathematics, their performance improves, while limited competencies are associated with lower performance.

**Table 5.** Relationship between competencies and performance of the respondents.

| Variables | Test | R-Value | Sig |
|---|---|---|---|
| Competencies and Performance | Spearman's rho | 0.264** | 0.005 |

**. Correlation is significant at the 0.01 level (2-tailed).

# CONCLUSIONS

Based on the findings of the study, the following conclusions were made.

1. The first-year college students have acquired a high level of competencies in terms of knowledge, values, and skills. This implies that classroom activities are effective in enhancing their personal growth, which they can apply to real-life situations.
2. The students have not mastered the topics, namely logic, inductive and deductive reasoning, measures of dispersion, probability and normal distribution, and linear regression and correlation. This implies that students have encounter difficulties in understanding these concepts suggesting the need for remedial activities, and the use of more contextualized examples to address the gap.
3. The students enrolled in Mathematics in the Modern World (MMW) have demonstrated an average level of performance in the subject. This implies that while students were able to meet the minimum expectation, there are still challenges that hinder them in achieving higher levels of mastery. Hence, there is a need to identify factors that affect their performance in the said subject.

4. The acquired competencies of students are significantly related to their performance in Mathematics in the Modern World (MMW). This implies that the lower competencies tend to have lower performance in MMW, while those with higher competency levels perform better.

# RECOMMENDATION

1. Teachers should encourage students to acquire and further develop knowledge, values, and skills in mathematics, since these are the necessary requirements to make learning meaningful and applicable to real-life situations.
2. Teachers should provide more contextualized examples, varied activities, and apply a variety of teaching strategies and techniques to help students understand difficult topics, such as logic, reasoning, measures of dispersion, probability, and regression. They should also encourage students to participate and ask questions during class discussions.
3. Since students have demonstrated an average performance in MMW, teachers may devise a peer tutorial program to assist those who have difficulty in mathematics.
4. Teachers should motivate and expose their students to the real world to gain more experience and appreciate the beauty of Mathematics. With these, they would perform better in the subject.

**Ethical Consideration**

All data collected for this study were obtained through voluntary participation and with the informed consent of each respondent. Participants were fully informed about the nature and scope of this research, how their data would be used, and their right to withdraw from the study at any time. Confidentiality and privacy were strictly maintained throughout the data collection and analysis process.

**Conflicts of Interest**

The authors declare no conflicts of interest regarding the publication of this paper.

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