

Evaluating the Performance of the Blackboard Ultra Learning Management System in Mapúa Malayan Colleges Mindanao using the ISO/IEC 25010 Model

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Abstract

This study aimed to evaluate the performance of the Blackboard Ultra Learning Management System utilized in Mapúa Malayan Colleges Mindanao (MMCM), known as MMCM Digital, using the ISO/IEC 25010 Software Quality Product Model. The study focused on the insights of the respondents who utilized the platform and evaluated it in terms of its functionality, efficiency, usability, compatibility, reliability, security, maintainability, and flexibility. The study also determined the significant differences in terms of the responses across program, sex, and year level. A researcher-made questionnaire was utilized as the research instrument, which was validated and conducted with a reliability test. There were 336 respondents taken from the eight programs of the College of Engineering and Architecture in MMCM through an online form. The results showed that the respondents strongly agreed on the performance of the learning management system, especially in terms of its functionality, usability, security, and maintainability. Furthermore, the study showed that there are no significant differences in the performance of the platform across different respondent profiles, including program, sex, and year level. The study recommends that further expansion be done to cater different academic levels and utilizing various technology evaluation frameworks.

Keywords: ISO/IEC 25010 model; Blackboard Ultra; Learning Management System; Mapúa Malayan Colleges Mindanao; Technology Management Framework

1. Introduction

Learning management systems (LMS) have grown widely in higher education recently. It provides a centralized platform for delivering online learning materials and assessments that connect educators and learners to succeed in an online learning environment. One well-known LMS globally used is the Blackboard Ultra (Ababneh et al., 2023). It is known for its features, such as content management, user management, reporting, and system integration. Mapúa Malayan Colleges Mindanao (MMCM) is a private higher institution utilizing Blackboard Ultra for five years, named MMCM Digital, and recently produced its alpha graduates. This study aims to evaluate the performance and impact of Blackboard Ultra at Mapúa Malayan Colleges Mindanao using ISO/IEC 25010, a software product quality model considering software quality, including learning management systems.

1.1. Statement of the Problem

The purpose of this study is to evaluate the extent to which the Blackboard Ultra Learning Management System in Mapúa Malayan Colleges Mindanao (MMCM Digital) meets the needs and requirements of students in terms of its performance and adherence to the ISO/IEC 25010 model's criteria. Specifically, the study aims to answer the following questions:

1. What is the demographic profile of the respondents in terms of:
 - a. Program
 - b. Sex
 - c. Year Level
2. What is the level of performance of the MMCM Digital platform in terms of:
 - a. Functionality
 - b. Efficiency
 - c. Compatibility
 - d. Usability
 - e. Reliability
 - f. Security
 - g. Maintainability
 - h. Flexibility
3. Is there a significant difference in the level of performance of MMCM Digital according to the respondent profiles?

1.2. Review of Related Literature

1.2.1. Learning Management Systems (LMS)

LMS is a software that provides a centralized platform for delivering education to all levels, from primary to university institutions; it manages educational content, facilitates communication and integration, and tracks progress. It is widely used in universities (Ndegeya, 2019) and offers advantages to all stakeholders. Lime-lights remote learning where education delivery continues to all, anytime and anywhere (Villanueva et al., 2023). However, not all institutions can use the platform optimally (Nguyen, 2021) presented the study of the difficulties encountered by the users due to poor guidance and unsuitable functions in such systems that lead to ineffective learning. Supported by (Papastergiou, 2009), few studies evaluate the fittings of learning management systems to institutions. User-based software required characteristics are essential for designing an LMS leading to effective learning. Enhancements of the platform are growing continually. Institutions are upgrading to newer versions (Akbar, 2019) and are focused on designing LMS based on end-user characteristics and needs. Continued LMS development involves improving the system's functions to meet the users' needs better while keeping up with technological advancements. It is now part of the education process, and all educational institutions must adapt, evaluate, and improve.

1.2.2. Blackboard Ultra

Blackboard Ultra is an application known for delivering online teaching, learning, building community, and sharing knowledge. It supplements traditional face-to-face classes by offering synchronous (real-time) and asynchronous (offline) mode options. For Blackboard ultra-synchronous mode, there are three-course

types: entirely online, hybrid blended, and web-enhanced, fit for all teachers and learners. Learning through Blackboard Ultra means no boundaries, continued course delivery, assessments, and student-teacher interaction in any circumstance can be delivered in real-time or can be extended over periods. Blackboard has been recognized and widely used globally by higher institutions, like King Saud University (Alturki, 2016) and Vietnam National University (Nguyen, 2021).

1.2.3. MMCM Digital

Mapúa Malayan Colleges Mindanao (MMCM) is an academic institution that offers Mapúa MCM Flux, a flexible learning ubiquitous experience instructional approach. It combines face-to-face classes and online learning. This course design is built on four fundamental characteristics: learner choice, equivalency, reusability, and accessibility. All course delivery and materials of Mapúa Malayan Colleges Mindanao are centered through MMCM Digital, powered by Blackboard Ultra. The platform has the compound learning environment of Blackboard Ultra, tailored to the institutions' fundamental characteristics. Other prominent universities and institutions in the Philippines used Blackboard as LMS, namely: Ateneo Graduate School of Business, Mapúa University and Colleges, Lyceum of the Philippines, Career Asia Academy, St. Paul's University, and Philippine Women's University (Malgapu, 2017). The institution is still in its early phase of operation. The academic community, the systems, and all platforms used, including the MMCM Digital, are subject to continued evaluation to check the alignment of the services, performance, and impact on the institution's mission and vision. Evaluating learning management systems helps institutions to improve teaching delivery and ensures meeting stakeholders' needs (Urera, 2019).

1.2.4. ISO/IEC 25010 Model

The software product quality model, or the ISO/IEC 25010, is a standardization to evaluate systems and software quality, including LMS. The evaluation is based on eight characteristics and sub-characteristics: functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. ISO/IEC 25010 model guides software developers and evaluators to assess the quality of a system or software products and improve the areas that need enhancement. The model was used to compare two LMSs, Moodle and Blackboard, to ensure quality and competence (Buntak, 2021). The model was used to evaluate the developed e-learning system (Urera, 2019). The model was applied to validate the effectiveness of an Android management system (Manglapuz, 2019).

1.3. Theoretical Framework



Fig. 1. ISO/IEC 25010 Software Quality Product Model

The study's theoretical framework is founded on the software product quality model or the ISO/IEC 25010. ISO/IEC 25010 model provides the perspective to evaluate the performance and impact of Blackboard Ultra in higher education institutions. It is the leading model for assessing software products (Estdale et al., 2018). The quality model evaluates the system and software products using the eight quality characteristics and sub-characteristics to check the satisfaction of the stakeholders' needs. Figure 1 shows that ISO/IEC 25010 has eight quality characteristics: functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability.

MMCM Digital is the software product to be evaluated. It is used globally as a centralized platform for delivering education on higher education. The quality model evaluates the performance and impact of the platform on stakeholders, using the eight quality characteristics.

1. Functionality is a characteristic that meets the implicit and explicit demands, compose of sub-characteristics of functional completeness, correctness, and appropriateness. It evaluates the essential functions and capabilities of MMCM Digital for delivering instructions and assessments to students, implementing functions without errors, and aligning software features to teaching disciplines.
2. Efficiency is the number of resources utilized under specific conditions, sub-characteristics of time behavior, utilization of resources, and capacity. It assesses the MMCM Digital responsiveness through prompt student interactions, simultaneous users, and slowdowns due to excess resources.
3. Compatibility characteristics can transfer and execute functions across different platforms (hardware and software), with sub-characteristics of co-existence and interoperability. It evaluates MMCM Digital exchange data to other educational systems and products.
4. Usability is the software product characteristics that different users can utilize to complete tasks with the following sub-characteristics: appropriateness, recognizability, learnability, operability, user error protection, user interface aesthetics, and accessibility. It explores the ease of navigation, interaction, engagement, collaboration, and range of operability of MMCM Digital.
5. Reliability characteristic is the ability of the system to perform specific functions under different conditions for some time and compose of the sub-characteristics: maturity, availability, fault tolerance, and recoverability. It investigates the consistency, sufficient testing and refinement, handling of errors, and having back-ups of MMCM Digital.
6. Security is a characteristic that evaluates the product or the system's protection by ensuring the appropriate data access for authorized users and types, sub-characteristics of confidentiality, integrity, non-repudiation, accountability, and authenticity. It seeks the students' perception of the protection, prevention, permissions, and authentication of personal data and learning materials of MMCM Digital.
7. Maintainability is characteristic of the modification effectiveness of the software product, the feature of adapting to changing environment with the sub-characteristics of modularity, reusability, analyzability, modification, and testability. It assesses the modular design of MMCM Digital, reusable modules, troubleshooting documents, adaptable platforms, testing and validating functions.
8. Flexibility is the efficient transfer of systems and software products across various environments; this characteristic has three sub-factors: adaptability, installability, and replaceability. It evaluates the MMCM Digital's customization settings, installation, and alternative learning management systems.

Researchers widely use the ISO/IEC 25010 model in evaluating systems and software. An e-learning system was developed and evaluated with the system's performance and effects on stakeholders using the ISO/IEC 25010 model; the result shows that the system is an effective, efficient, and quality e-learning tool (Urera, 2019).

The study utilizes the software product quality or the ISO/IEC 25010 model as the theoretical framework to evaluate the performance and impact of the learning management system in higher education. It improves the quality of software products by providing a standard framework for understanding, controlling software quality, identifying, and prioritizing crucial characteristics for a specific software product, lowering the possibility of errors, and raising stakeholder satisfaction levels. The study will provide light on MMCM Digital's performance and impact on the stakeholders in higher education.

1.4. Conceptual Framework

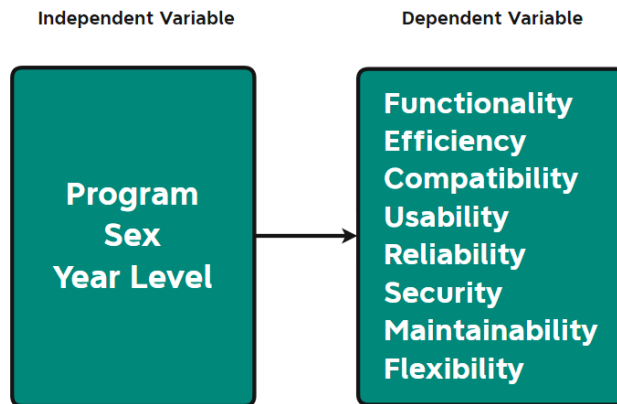


Fig. 2. Relationship of the Variables

Figure 2 illustrates the conceptual framework for evaluating the performance and impact of MMCM Digital in higher education institutions. It illustrates the relationship between the independent variables, respondent profile: the program, sex, and year level of the students, and the dependent variables, MMCM Digital's performance level and impact: the eight characteristics from ISO/IEC 25010 model.

2. Methods

2.1. Research Design

The study will use a quantitative descriptive design to collect and analyze numerical data about the MMCM Digital learning management system performance. Quantitative data will be gathered through surveys or questionnaires administered to students of Mapúa Malayan Colleges Mindanao who are users of the platform. The surveys will focus on specific variables related to the platform's performance, such as functionality, reliability, usability, security, maintainability, performance efficiency, compatibility, and flexibility. By employing descriptive statistical analysis, the researchers will gain a comprehensive understanding of the performance attributes (Senol et al., 2014), strengths, and areas for improvement of the platform.

2.2. Research Locale and Respondents

The study will be conducted at Mapúa Malayan Colleges Mindanao, focusing on the College of Engineering and Architecture. This institution has been using the MMCM Digital platform since 2018 and constantly adapting to its features and functions. The study's respondents will be the students at this college to gather targeted and specific feedback on the platform's performance within this demographic.

The study will utilize the proportional stratified sampling technique wherein the number of respondents assigned to the different strata is proportional to the representation of the strata in the target population (Ilyas & Etikan, 2021). The College of Engineering and Architecture has 1,646 1st to 4th-year students across the eight programs. Using Slovin's formula, a total of 336 students will be proportionally sampled, and the distribution table is found below:

Table 1. Distribution of the Respondents

Program	Population	Sample
Architecture	397	80
Chemical Engineering	85	20
Civil Engineering	730	144
Computer Engineering	92	20
Electrical Engineering	63	16
Electronics Engineering	60	12
Industrial Engineering	77	16
Mechanical Engineering	142	28
Total	1,646	336

2.3. Research Instrument

The study will use a 31-item researcher-made questionnaire to assess the MMCM Digital platform based on the ISO/IEC 25010 model. The questionnaire was validated and will capture the following characteristics and sub-characteristics. Prior to the deployment of the questionnaire, a pre-study among 20 students was performed to test the reliability of the researcher-made questionnaire. The table below shows the results of the Reliability Analysis of the pre-study:

Table 2. Reliability Statistics

Estimate	Cronbach's α
Point estimate	0.912
95% CI lower bound	0.896
95% CI upper bound	0.925

A Cronbach's alpha value of 0.912 indicates that the questionnaire demonstrates strong internal consistency, meaning that the items are reliable and consistently measure the same underlying concept. Researchers can have confidence that the responses obtained from the questionnaire are dependable and accurately reflect the students' perceptions of MMCM Digital's performance.

2.4. Data Gathering Procedure

The data-gathering procedure for the research will involve the following steps:

1. A researcher-made questionnaire will be developed based on the ISO/IEC 25010 model. The questionnaire will assess the following characteristics of the Blackboard Ultra LMS: functionality, reliability, usability, security, maintainability, performance efficiency, compatibility, and flexibility.
2. A pre-study will be done to test the reliability of the questionnaire, to which 20 students will be utilized across all programs. Cronbach's Alpha will be utilized to determine the extent of homogeneity of the questionnaire.
3. Once the questionnaire is found reliable, it will be administered to a sample of students at Mapúa Malayan Colleges Mindanao, under the College of Engineering and Architecture, using quota sampling through an online form.
4. The data collected from the questionnaires will be analyzed using descriptive statistical methods. The analysis results will be used to evaluate the performance of the Blackboard Ultra LMS.

2.5. Statistical Tools

A 4-point Likert scale will be used in the researcher-made questionnaire to measure participants' perceptions and evaluations of the MMCM Digital system across the ISO/IEC 25010 model's characteristics. The scale will provide a range of response options, from strongly disagree to strongly agree, allowing respondents to indicate their agreement or disagreement with specific statements or items (Ganeser & Robert, 2021). The table below shows the 4-point Likert Scale (Pimentel, 2019) and its interpretation.

Table 3. Likert Scale Interpretation

Mean Levels	Responses	Interpretation
1.00 to 1.75	Strongly Disagree	Participants strongly agree with the statement, indicating high satisfaction or positive perception of MMCM Digital's performance.
1.76 to 2.51	Disagree	Participants agree with the statement, suggesting a moderate level of satisfaction or positive perception of MMCM Digital's performance
2.52 to 3.27	Agree	Participants disagree with the statement, indicating a moderate level of dissatisfaction or negative perception of MMCM Digital's performance
3.28 to 4.00	Strongly Agree	Participants strongly disagree with the statement, reflecting a high dissatisfaction or negative perception of MMCM Digital's performance.

Descriptive statistics, such as measures of central tendency (mean, median) and measures of variability (standard deviation), will be used to summarize and analyze the responses (Mishra et al., 2019). These statistical tools will enable the researchers to obtain a comprehensive overview of participants' perceptions regarding the performance of the MMCM Digital system, highlighting the strengths and weaknesses across the evaluated characteristics.

2.6. Ethical Considerations

Throughout the data-gathering procedure, ethical considerations will be upheld. Informed consent will be obtained from the participants, and their confidentiality and privacy will be protected (Haggerty & Hawkins, 2000). The researchers will also ensure adherence to ethical guidelines and seek necessary approvals from relevant institutional review boards or ethical committees.

3. Results

3.1. Demographic Profile of the Respondents

Table 4. Respondent Profile

Demographic Profile	N	Percentage
Program		
Architecture	80	23.95%
Civil Engineering	144	43.11%
Chemical Engineering	20	5.99%
Computer Engineering	20	5.99%
Electrical Engineering	12	3.59%
Electronics Engineering	16	4.79%
Industrial Engineering	16	4.79%
Mechanical Engineering	28	8.38%
Total	336	100%
Sex		
Male	213	63.77%
Female	123	36.83%
Total	336	100%
Year Level		
1st Year	84	25%
2nd Year	84	25%
3rd Year	84	25%
4th Year	84	25%
Total	336	100%

The table above shows the distribution of the 334 respondents of the study, which were the students at the College of Engineering and Architecture of Mapúa Malayan Colleges Mindanao. As for the distribution based on the program, the Civil Engineering program had the most significant number of respondents, amounting to 43.11% of the sample population. In contrast, the Electrical Engineering program had the least respondents, 3.59% of the sample population. In terms of sex, a total of 213 male and 123 female students, amounting to 63.77% and 36.83% of the population, respectively, were gathered and distributed among the programs. Lastly, the year-level distribution was even at 84 respondents per year, which amounted to 25% of the sample population.

3.2. Performance of MMCM Digital according to the ISO/IEC 25010 Model

Table 5. Evaluation Summary

Demographic Profile	Mean	Standard Deviation	Interpretation
Functionality	3.287	0.489	Strongly Agree
Efficiency	3.005	0.456	Agree
Compatibility	3.207	0.539	Agree
Usability	3.297	0.463	Strongly Agree
Reliability	3.129	0.474	Agree
Security	3.336	0.460	Strongly Agree
Maintainability	3.293	0.405	Strongly Agree
Flexibility	3.050	0.516	Agree
Overall	3.201	0.475	Agree

The table above shows the survey results on the performance of MMCM Digital following the characteristics of ISO/IEC 25010. Based on the data, it can be shown that the respondents strongly agree on the performance of MMCM Digital in terms of Functionality ($M = 3.287$, $SD = 0.489$), Usability ($M = 3.297$, $SD = 0.463$), Security ($M = 3.336$, $SD = 0.460$), and Maintainability ($M = 3.293$, $SD = 0.405$).

The result merits that the respondents indicate a high level of satisfaction with MMCM Digital in terms of its capability to provide functions that meet the stated and implied needs of the intended users, capability to exchange information between a user and an interactive system through a user-interface, capability to protect information and data, and capability to be modified by the intended maintainers with effectiveness and efficiency.

Overall, the respondents agree with the performance of MMCM Digital following the eight characteristics of the ISO/IEC 25010 model with a mean of 3.201 and SD of 0.475. Relative to this, there is a moderate level of satisfaction overall reflected in the LMS platform.

3.3. Performance of MMCM Digital across Sex

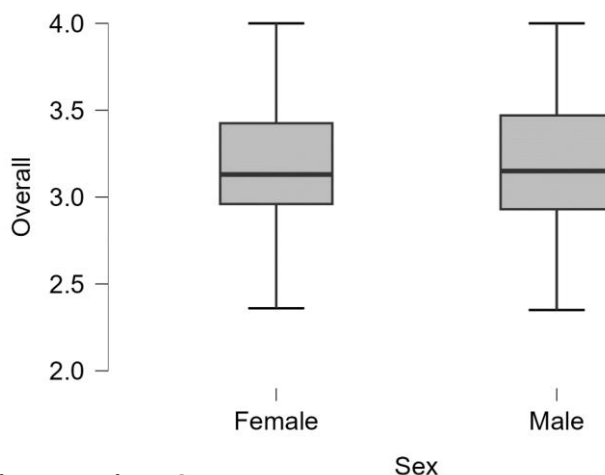


Fig. 3. Box Plot of the evaluation according to Sex

The box plot indicates that the central tendency of the data is slightly higher for the male group (median = 3.15) than the female group (median = 3.13). The boxes are similar, suggesting comparable variability within the middle 50% of data for both groups. Additionally, the absence of outliers implies that no extreme values in either group significantly deviate from the rest of the data.

Table 6. Statistical Summary of the evaluation according to Sex

Variables		N	Mean	Median	Standard Deviation	W	p-Value
Dependent	Independent						
Performance	Female	123	3.208	3.130	0.364	13215.5	0.895
	Male	123	3.208	3.130	0.364		

Statistically, a Mann-Whitney U test is conducted to sample the survey results independently. From the table above, there is no significant difference in the overall performance of MMCM Digital across sex (p-Value = 0.895). The result indicates that sex does not influence the responses of the overall performance of the platform.

3.4. Performance of MMCM Digital across Year Level

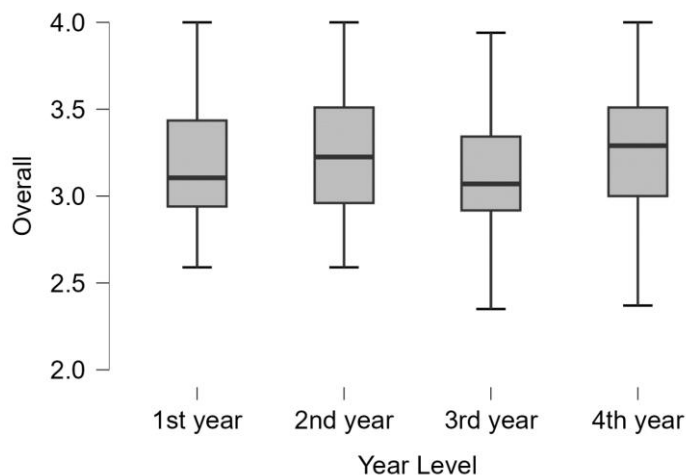


Fig. 4. Box Plot of the evaluation according to Year Level

The box plot reveals that the medians vary across the academic year groups, with fourth-year students having the highest median satisfaction level (median = 3.290) and first-year students having the lowest median satisfaction level (median = 3.105). Moreover, the boxes in the plot indicate that the second year and fourth-year groups have relatively similar data distributions, as their boxes are of comparable sizes. Conversely, the third-year group shows a slightly lower data spread, suggesting that the responses in this group are more concentrated around the median.

Table 7. Statistical Summary of the evaluation according to Year Level

Variables		N	Mean	Median	Standard Deviation	p-Value
Dependent	Independent					
Performance	First Year	84	3.202	3.105	0.387	0.138
	Second Year	84	3.248	3.225	0.398	
	Third Year	84	3.125	3.070	0.386	
	Fourth Year	84	3.228	3.290	0.317	

A Kruskal Wallis H test was performed on the year levels to test for the significant difference in terms of the overall performance of MMCM Digital. There was no significant difference between the first-year, second-year, third year, and fourth-year levels, with a p-value of 0.138. This result indicates that the year level does not influence the responses of the overall performance of the platform.

3.5. Performance of MMCM Digital across Program

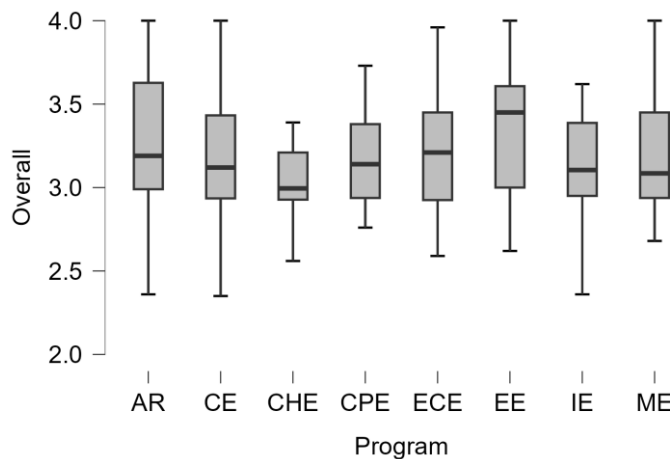


Fig. 5. Box Plot of the evaluation according to Program

The box plot shows notable differences in student satisfaction levels across various academic programs. The box plot highlights variations in satisfaction levels among students across different academic programs. The programs of EE and ECE stand out with the highest median satisfaction levels (medians of 3.450 and 3.210, respectively). Meanwhile, the programs of CHE and IE exhibit relatively lower median satisfaction levels (medians of 2.995 and 3.105, respectively).

Additionally, the plot indicates that the data spread varies among the programs. Programs with larger IQR values, such as AR, EE, and ECE, display a wider distribution of satisfaction scores, suggesting more significant variability among the students' responses within these programs.

Table 8. Statistical Summary of the evaluation according to Program

Dependent	Variables	N	Mean	Median	Standard Deviation	p-Value
	Independent					
Performance	Architecture	80	3.292	3.190	0.441	0.155
	Chemical Engineering	20	3.179	3.120	0.351	
	Civil Engineering	144	3.018	2.995	0.236	
	Computer Engineering	20	3.182	3.140	0.304	
	Electrical Engineering	12	3.188	3.210	0.369	
	Electronics Engineering	16	3.358	3.450	0.436	
	Industrial Engineering	16	3.123	3.105	0.349	
	Mechanical Engineering	28	3.179	3.085	0.356	

A Kruskal Wallis H test was performed on the programs to test for the significant difference in the overall performance of MMCM Digital. There was no significant difference between the eight programs, as indicated by a p-Value of 0.155. The result indicates that the program does not influence the responses of the overall performance of the platform.

4. Findings, Conclusion, and Recommendations

4.1. Findings

The study's findings indicate that the respondents strongly agree that MMCM Digital provides the necessary capabilities for efficient utilization in terms of Functionality, Usability, Security, and Maintainability. Moreover, the respondents agree that MMCM Digital provides the capabilities needed for utilization in terms of Efficiency, Compatibility, Reliability, and Flexibility. Overall, the survey results indicate that the respondents agree that MMCM Digital is a learning management system that performs efficiently and that there is a moderate level of satisfaction amongst the respondents.

In addition, the results show no significant differences in the overall performance of MMCM Digital across the three variables. These results indicate consistent performance across various groups, implying that MMCM Digital is an effective and accessible platform for students regardless of their sex, academic year, or program. The findings provide valuable insights for educational institutions and administrators, highlighting the robustness and inclusivity of MMCM Digital as a learning management system.

4.2. Conclusion

The study aimed to assess the overall performance of MMCM Digital based on the ISO/IEC 25010 Software Quality Model and the relationship of its results across the program, sex, and year level. A total of 336 respondents came from the eight programs of the College of Engineering and Architecture, including Architecture, Civil Engineering, Chemical Engineering, Computer Engineering, Electrical Engineering, Electronics Engineering, Industrial Engineering, and Mechanical Engineering. In addition, the respondents comprised both male and female students and belong to different year levels, ranging from first year to fourth year.

The study evaluated the performance of MMCM Digital in terms of functionality, efficiency, compatibility, usability, reliability, security, maintainability, and flexibility. The platform generated positive feedback ranging from moderate to high levels of satisfaction from the respondents. It was practical and functional, provided smooth user experience, demonstrated good compatibility, was highly usable, highly reliable, perceived as secure, deemed maintainable, and flexible.

Based on the statistical analysis, the study found no significant difference in MMCM Digital's performance level across different respondent profiles, including program, sex, and year level. The platform exhibited consistent performance and effectiveness regardless of these variables.

MMCM Digital demonstrated positive performance in various aspects, catering to student's diverse needs and preferences across different academic programs and year levels. The findings suggest that the platform effectively supports online learning and contributes to a conducive digital learning environment for students. The study's results provide valuable insights for educational institutions, informing the continuous improvement and optimization of online learning platforms to meet the evolving needs of the student community.

4.3. Recommendations

The following recommendations can be made:

1. The study can be expanded to cover the different colleges and even the high school department of the institution. By including students from various colleges and the high school department, the study can provide comprehensive insights into how MMCM Digital caters to student's diverse needs and requirements across different educational levels and disciplines. In addition, each academic level may have unique demands, expectations, and preferences, which can be better captured and addressed.
2. Different technology management frameworks, other than ISO/IEC 25010, can be used to evaluate the performance of the learning management system. By incorporating multiple frameworks, the research can provide a more comprehensive and multidimensional assessment of the platform's effectiveness, addressing various aspects of technology management, implementation, and user experience. There can be frameworks such as the technology acceptance model and the technology, usability, and pedagogy (TUP) model can be used to evaluate the system further.
3. There can be more statistical tools involved, other than descriptive and basic inferential statistics, to provide a clearer picture of the statistics involved in the analysis of the performance of the system. Tools such as correlation, regression, factor analysis, and even machine learning can be involved in further studies to obtain a more comprehensive and holistic grasp of the nature of the data involved.
4. The study results can be used as an intervention or correctly identify the students' needs across different academic levels. By leveraging the findings, Mapúa Malayan Colleges Mindanao can implement targeted improvements and tailor the learning management system, MMCM Digital, to better cater to the diverse needs of its student community.

Acknowledgements

The researchers would like to express our deepest gratitude and appreciation to all individuals and institutions who contributed to completing this study titled "Evaluating the Performance of MMCM Digital in Mapúa Malayan Colleges Mindanao using the ISO/IEC 25010 Model." Heartfelt thanks go to the

administrators and faculty of Mapúa Malayan Colleges Mindanao for their unwavering support, valuable insights, and encouragement throughout the research process.

The researchers would like to sincerely thank the students who willingly participated in the study, generously sharing their time and feedback. Their contributions were instrumental in shaping the findings and enriching the study's outcomes. The researchers would also like to acknowledge the research advisors and experts, especially Dr. Mark Van M. Buladaco, whose guidance and expertise played a crucial role in the study's design, data analysis, and interpretation.

Finally, the researchers would like to thank their family and friends for their continuous support, understanding, and encouragement during this research endeavor.

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