

ISO 9126 Quality Model For Evaluating of Student Portal: Al-Madinah International University (Case Study)

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Abstract

E-learning is a teaching system that involves electronic resources such as computers and the Internet, and the student portal is an essential tool that supports learning in universities. However, there is a limited evaluation model for educational websites. Therefore, a framework is required to guide the creation of such a model. The study conducted evaluates the quality of the student portal at Al-Madinah International University based on ISO 9126 quality model from the student's perspective, and the results show a good quality portal. Nonetheless, students suggest improvements to enhance its effectiveness, ease of use, and learning process.

Keywords: ISO 9126; Al-Madinah International University; Quality Model; Student Portal.

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DOI: <https://doi.org/10.21834/e-bpj.v8iS15.5104>

1.0 Introduction

The significance of website quality is crucial due to the vast number of domains accessible on the internet today. Various models have been proposed for evaluating website quality, but most research conducted has focused on the usability feature of the website. Website quality evaluation is essential for identifying areas that need improvement and ensuring the website meets user expectations. Portals are gateways that allow users to obtain information from various sources presented on a single page, and the importance of high-quality web portals for organizations is increasing due to the rapid progress of Information and Communication Technology. Al-Madinah International University operates on the student portal system, and this paper aims to evaluate the Academic Portal using the ISO 9126 standard. This standard is commonly used for software evaluation and comprises six quality characteristics: functionality, reliability, usability, efficiency, maintainability, and portability (Pamungkas, 2018). Al-Madinah International University's management is striving to enhance the institution's quality, including its website. Currently, there are few models for evaluating academic website quality, with most only focusing on general factors. However, educational institutions need to evaluate and improve their website quality to meet students' demands. To address this, a framework for evaluating academic website quality from the perspective of student users is necessary. The present study seeks to evaluate an improved framework for assessing academic website quality.

For this study, the following research inquiries will be conducted:

1. How do ISO9126 standards define website quality?
2. How does the Student Portal differ from other websites for academic purposes in terms of quality?
3. How effective is Al-Madinah International University's student portal using the ISO 9126 quality model?

The purpose of this research is to evaluate the student portal of Al-Madinah International University by surveying its users through the User Experience Questionnaire (UEQ), which looks at aspects such as functionality, reliability, and efficiency. The objectives of the study are to assess the quality of the website based on ISO9126 standards, identify quality aspects specific to the student portal, and make suggestions for improvement. The study has proposed a simplified quality evaluation framework for academic websites that has significance in both societal and economic contexts. The use of this framework will enable academic websites to improve their usability and navigation based on the evaluation outcomes. This will benefit both website users and academic institutions by increasing user satisfaction and return on investment.

2.0 Literature Review

The quality of a website is crucial in attracting users and generating revenue. A website's quality is determined by factors such as design, user-friendliness, accessibility, the value offered to users, and meeting users' expectations (Gupta, 2021). The quality of a website can be evaluated from two perspectives: programmers and end-users. Programmers focus on maintainability, security, and functionality, while end-users focus on usability, efficiency, and credibility. A website quality model can be used to define and measure website quality. A university portal falls under the category of corporate portals that offer personalized services to users particularly the academics and the students. A student portal in an academic institution is designed to provide students with the information needed for their academic journey, including access to their course schedules, grades, academic resources, and other relevant information related to their studies.

2.1 What Is Quality

Quality is an abstract concept that refers to the degree of excellence or superiority of something, often in comparison to a set of standards or expectations, often it is challenging to provide a precise definition, but the absence of it is readily apparent through one's perception. We often use terms like "excellent quality" and "low quality" in our daily lives to describe how well something performs. People generally have an intuitive understanding of quality, but struggle to give it a clear definition (Kapferer & Valette-Florence, 2021). While quality can sometimes be associated with expensive goods, it's not always the case. Although quality can be perceived, assessed, and comprehended, it cannot be quantified or controlled. However, it's important to establish, measure and regulate the quality of a product to increase its usage and acceptability (Kaur & Pruthi, 2022). Different definitions of quality exist based on various perspectives (Dolinina et al., 2018) each providing a distinct definition of quality.

Software quality can be defined by its ability to meet specified criteria and user expectations. Evaluating the quality of software and web products can be challenging without appropriate models or frameworks that consider all quality attributes. Web applications have unique characteristics, (Luna, et al. 2018), such as their interactive and content-driven nature, which require a balance between artistic and technical skills. Internationalization and accessibility for users with impairments are significant issues for web applications.

2.2 Quality Model

A quality model refers to a set of characteristics and their interrelationships that help determine quality requirements and evaluate product quality. Several studies have explored software product evaluation, including important models such as Bayesian, McCall, FURPS, Boehm, Dromey, and ISO 9216 (Bitkina, et al., 2020). The first quality model for system developers and system development processes has been created by Al-Obthani (Al-Obthani, 2018), using McCall's model to connect users and developers through various software quality factors that reflect both user perceptions and developer priorities. Another outstanding quality model produced by (Boehm et al., 1978), uses attributes and metrics to define software quality qualitatively. This model represents high-level, intermediate-level, and primitive characteristics.

2.3 ISO 9126 Model

The ISO 9126 quality model is a well-known international standard for measuring software quality that was introduced in 1992. It is derived from the McCall model and consists of three levels of quality characteristics, sub-characteristics, and attributes (Lami, 2017). The model identifies 21 attributes that are split into six domains: functionality, reliability, usability, efficiency, maintainability, and portability.

Additionally, the model recognizes three types of software product quality: internal quality, external quality, and quality in use. The standard can be broken down into four parts:

1. ISO/IEC 9126-1

The ISO/IEC 9126-1 standard provides a quality model for a software evaluation, which includes characteristics, sub-characteristics, and attributes in a hierarchy (Gil & Hernández, 2018). The model distinguishes between internal and external quality and includes quality in use attributes to measure the user's perception of quality (Budiman & Tejawati, 2018). Measurable software qualities, such as

characteristics, sub-characteristics, and attributes, are positioned at the bottom of the hierarchy. These characteristics turn become criteria for quality.

2. ISO/IEC 9126-2

In ISO/IEC 9126-2, external metrics for measuring the quality of software are presented. These metrics are relevant to the executable software product during testing and at later development stages, as well as during operation. In summary, this standard specifies how to measure the external quality characteristics of software (Cho & Jang, 2016).

3. ISO/IEC 9126-3

ISO/IEC 9126-3 is a standard that outlines internal metrics for measuring software quality characteristics during the design and coding stages of development. These metrics are relevant to non-executable software products and are intended to be used at the beginning of the development process (Beckhauser et al., 2018).

4. ISO/IEC 9126-4

ISO/IEC 9126-4 is a standard that outlines quality characteristics and metrics for software, specifically focusing on quality in use. This standard provides metrics for evaluating the quality of software while it is being used, rather than during its development or testing phases. In essence, it offers guidance for measuring how well a software product performs in real-world scenarios.

ISO/IEC 9126 has various benefits such as:

- a) It unifies and quantifies different perspectives of quality requirements, making it easier to understand (Abidin & Mansor, 2019).
- b) The proposed characteristics are appropriate for all software types, providing reliable terms for software product quality (Abidin & Mansor, 2019).
- c) The standard model includes essential characteristics, evaluation criteria, hierarchical structure, complete expression and terms, clear definitions, and relationships between different model layers (Djouab & Bari 2019).
- d) ISO 9126 helps in strategic decision-making, preventing detrimental mistakes (Kakucha et al., 2018).

However, the ISO/IEC 9126 model standard also has limitations:

- a) It fails to explain the needs of managers in terms of return on investment and sustainability quality factors (Kakucha et al., 2018).
- b) The lacks the element of software traceability and data consistency and doesn't account for methods of measurement or the depiction of the traits and attributes of employed software (Kakucha et al., 2018).
- c) It can't evaluate software created before delivery or acceptance (KOSGEY, J. K. K., 2017).

The ISO/IEC 9126 quality model for software products has major advantages and can be extended to include new quality characteristics based on its usability. The extended model displays the characteristics that fulfill the needs of end users, software developers, and business managers. The ISO 9126 model is useful across various systems (Farid, et al., 2018), including those in the academic domain, such as e-learning systems. It has been used in evaluating e-learning systems, course management systems, computer-based systems, and B2B applications. The model is simple to comprehend and easy to use.

2.4 ISO 9126 Factors

The ISO 9126 model describes software quality based on four main factors, including functionality, reliability, usability, efficiency, Portability, and maintainability:

a) Functionality

Functionality is the capability of software to provide functions that meet the stated and implied needs of users when used under specified conditions (ISO, 2001). This characteristic has four sub-characteristics, namely suitability, accuracy, interoperability, and security.

b) Reliability

Described as the capability of software to maintain its level of performance under stated conditions for a stated period (Ferreira, 2019). It is represented by three sub-characteristics, namely maturity, fault tolerance, and recoverability.

c) Usability

Usability is subdivided into operability, learnability, understandability, and attractiveness. Good usability means that the learning process is seamless, free of hindrances, and can be achieved through designing a user interface (Popereshnyak & Vecherkovskaya, 2019), or content that fits the user.

d) Efficiency

Efficiency relates to the software product's ability to perform correctly on the number of used resources (Paredes & Hernandez, 2020). It is further subdivided into Time Behavior, Resource Behavior, and Efficiency Compliance.

e) Maintainability

Maintainability concerns the software product's ability to be modified, corrected, improved, or adapted to changes occurring within the environment.

f) Portability

Portability describes attributes associated with the software's capability in being relocated from one environment to another.

Overall, the ISO 9126 model provides a comprehensive framework to evaluate software quality based on the specific needs of different environments.

3.0 Methodology

To gather thorough and precise data, this study employs both descriptive techniques and a descriptive survey approach as its research methodology. A questionnaire was created based on the literature research, and Structural Equation Modeling (SEM) was used to

analyze the data and predict associations between constructs. In the study of a student portal, a questionnaire was utilized to assess the site's quality and usability, and it was analyzed for consistency using reliability analysis techniques. This was followed by the development of a research strategy in the initial stage, which included a literature review and field survey. To ensure that the questionnaire would help achieve the study's objective and be easy to answer, it underwent revisions in a pilot study. The group of participants or objects studied by researchers, known as the statistical target population is identified and, in this research, works the All Al-Madinah International University students at the Bachelor level were included in the study. The goal of sampling is to use a representative sample to learn about the population. Probability sampling is used in quantitative research to randomly select a representative group (Pilipović & Simeunović, 2021), while purposive sampling is used in qualitative research to address specific research issues. Purposive sampling works with individuals, organizations, or institutions, while probability sampling selects a representative stratum or large sample at random to evaluate how well the sample represents the population. Sampling is a method of selecting a portion of the population to represent a larger population for study. In this research, the information requested in a survey will be used from Al-Madinah International University students who have completed their first semester due to their knowledge and experience using the student portal. The sample size is important in statistical analysis, with a larger sample size being necessary for more complex analyses. Calculating the sample size involves determining the number of observations or experimental conditions necessary to determine a phenomenon's variability. Therefore, in this study, a sample size of 240 participants, or 35% of the 690 students who finished the first semester at Al-Madinah International University was determined using a sample size formula with a 99% confidence level, a 50% standard deviation, and a 5% margin of error.

4.0 Research Analysis

The data were checked for errors and unusual values to ensure accuracy and normal distribution. Multivariate outliers were identified using a Mahalanobis Distance score higher than the Chi-square value. Descriptive statistics were used to evaluate data input, with only four surveys showing extreme values. The normality distribution was also tested for skewness and kurtosis, which respectively measure symmetry and peakedness/flatness. Positive kurtosis indicates a sharp peak, while negative kurtosis denotes a flat distribution (Bowman & Heath, 2023). Skewness indicates the swing of the scale to both sides, with positive and negative values indicating left and right-sided skews, respectively. The results of kurtosis and skewness were presented in Table 1 for all variables.

Table 1. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Functionality	234	1.00	5.00	3.5604	.90160	-.525	.159	.001	.317
Usability	234	1.00	5.00	3.4676	.91058	-.541	.159	-.015	.317
Reliability	234	1.20	5.00	3.5017	.84554	-.350	.159	-.131	.317
Efficiency	234	1.00	5.00	3.5951	.91734	-.537	.159	.051	.317
Quality	234	1.00	5.00	3.4786	.93495	-.625	.159	.373	.317
Valid N (listwise)	234								

Based on the skewness and kurtosis analysis, the collected data was found to be within an acceptable range, indicating a normal distribution that is appropriate for further analysis. The values for skewness did not exceed the recommended range (Bowman & Heath, 2023), and the kurtosis statistics were within the typical range of -3 to +3. Therefore, there was no reason to be concerned about the normality distribution of the data. Overall, the data collection met the criteria for normality and was appropriate for regression analysis. Data screening and cleaning showed that all five components in Table 2 are constructed and valid. The reliability of each scale is checked using Cronbach's alpha, and iterative analysis is used to establish their reliability. Items that lead to significant improvements in reliability are removed and the analysis is repeated, but not all deletions that result in minor improvements are made. The study employed five multi-variable components that underwent many reliability testing procedures, and the construct as a whole is considered reliable when Cronbach's alpha score is at least 0.848 for Masculinity/Femininity.

Table 2. Reliability Coefficient for Multiple Items

Variable	Alpha (a)	Number of items
Reliability	.848	5
Functionality	.898	7
Usability	.940	12
Efficiency	.875	4
Quality	.855	5

Questionnaires collected personal information including personal and demographic information from the participants, such as their gender, profession, job, and education. This information in Table 3 helps the researcher gain a better understanding of the sample profile selected for the study and identify any discrepancies in the measurements.

- a) Gender: Female respondents made up 50.4% of the total respondents, while male respondents made up just 49.6%.
- b) Faculty: The number of respondents from each faculty is shown in the table below, with the Faculty of Islamic Studies receiving the highest proportion (38.5%) out of a total of 90 replies. The other faculties were represented by a range of 11% to 20%.

Table 3. Number of Respondents from Each Faculty

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Faculty Of Islamic Sciences	90	38.5	38.5	38.5
	Faculty Of Computer & Info. Tech	47	20.1	20.1	58.5
	Faculty of Education	28	12.0	12.0	70.5
	Faculty of Finance & Admin. Science	42	17.9	17.9	88.5
	Faculty Of Languages	27	11.5	11.5	100.0
	Total	234	100.0	100.0	

c) Frequency: Table 4 explains the frequency of port visits made by the user, which indicated a high proportion of between 4 and 5 times each week, with 32%. Whereas the remaining times fell between 11 and 26 times each week.

Table 4. Frequency of Port Visits

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Daily	61	26.1	26.1	26.1
	4-5 times a week	75	32.1	32.1	58.1
	2-3 times a week	37	15.8	15.8	73.9
	Once a week	35	15.0	15.0	88.9
	Seldom	26	11.1	11.1	100.0
	Total	234	100.0	100.0	

According to Table 5, all of the hypotheses (H1, H2, H3, and H4) are supported as there is a positive correlation between the IV and DVs. A Sig value of less than 0.01 in the correlation test indicates a relationship between the two variables (Gerald, 2018). The table below shows that the correlation coefficient between the two variables is 0.000. This finding shows that there is a significant positive correlation.

Table 5. Hypothesis Testing

The Hypothesis	Beta Value	Sig. Test	Hypothesis Result
H1. There is a positive relationship between functionality and the quality of the student portal at MEDIU University	.696**	.000	Accepted
H2. There is a positive relationship between reliability and quality the quality of the student portal at MEDIU University	.691**	.000	Accepted
H3. There is a positive relationship between usability and quality the quality of the student portal at MEDIU University	.674**	.000	Accepted
H4. There is a positive relationship between efficiency and quality the quality of the student portal at MEDIU University	.710**	.000	Accepted

The improvement in the results after the predictor variables were included provides evidence that the predictors were indeed linked to the quality of the student portal, according to preliminary results of the chi-squared tests and pseudo-R square values that assess the effectiveness of the regression model (testing the overall fit of the model). At a significance level of 0.001, the total Adjusted R Square for the regression model used to estimate the quality of the student portal at MEDIU University was 10.9%. The F Change is evaluating whether the regression equation's most recent contribution reflects a meaningful improvement. At $F = 4.381$, $P = 0.001$, the model was significant. The goal is to provide an assessment Of Al-Madinah International University's Student Portal using the ISO 9126 Quality Model (Case Study). To find the statistically significant differences between the study's variables, one-way ANOVA analysis was used to evaluate the demographic data and t-test analyses (gender). Since $t - \text{computed} (241) > t - \text{tabulated}$, the outcome was approved. No differences in work satisfaction between male library staff members, with a mean value of 31.971. The mathematical link between each independent variable and the dependent variable is also described by the coefficients. The table below illustrates and indicates that the correlation coefficient between the two variables is all below 0.005, hence this relationship is not statistically significant according to the p-values for the coefficients. This finding in Table 5 indicates that all variables have a substantial positive association; as a result, H1, H2, H3, and H4 are supported at the zero-order level.

5.0 Conclusion

The research focused on quality and its importance in achieving customer satisfaction. It is discovered that excellent quality products are those that fulfill their intended purpose and make people happy to use them. The study also highlighted the importance of website quality standards, including navigation, design, and user experience, in creating a positive experience for website users. The research suggested that academic institutions could benefit from using quality standards to evaluate their student portals, identify areas for improvement, and increase student satisfaction. The results of the study showed that the student portal had a good level of quality assessment from the users' perspective.

This study describes metrics for assessing the quality of websites but acknowledges that there may be aspects of website quality that are not fully defined. A more thorough study is needed to explore the website quality of a particular site, such as the main website

for Al-Madinah International University, with a focus on academic quality. As websites continue to evolve, with an increasing emphasis on mobile devices, website design may need to change, and the website quality metrics will need to adapt to meet this new challenge. Despite the existence of web evaluation tools, there are still problems with using these tools to automatically assess website quality

Acknowledgments

The authors would like to thank Kedah International Conference on Social Science and Humanities, UiTM Kedah (Online), Malaysia for supporting participation in the 2nd International Conference on Business, Finance, Management and Economics (BIZFAME).

Paper Contribution to Related Field of Study

This paper contributes to the field of Information and communication technology.

References

- Abidin, W. Y. N. W. Z., & Mansor, Z. (2019). The criteria for software quality in information system: Rasch Analysis. *Editorial Preface From the Desk of Managing Editor...*, 10(9).
- Al-Obthani, F. S. (2018). Towards customized smart government quality model. *International Journal of Software Engineering & Applications (IJSEA)*, 9(2).
- Beckhauser, E., Savaris, A., von Wangenheim, A., & Krechel, D. (2018, June). ISO Compliant Evaluation of a Teledermatology Structured Report System for the Brazilian Public Healthcare. In *2018 IEEE 31st International Symposium on Computer-Based Medical Systems (CBMS)* (pp. 135-140). IEEE.
- Bitkina, O. V., Kim, H. K., & Park, J. (2020). Usability and user experience of medical devices: An overview of the current state, analysis methodologies, and future challenges. *International Journal of Industrial Ergonomics*, 76, 102932.
- Boehm, B., Brown, R., Kaspar, H., Lipow, M., McLeod, G., & Merritt, M. (1978). *Characteristics of software quality*. trw series of software technology, trw systems and energy. Inc., also published by North Holland, 1973.
- Bowman, N., & Heath, M. T. (2023). Computing minimum-volume enclosing ellipsoids. *Mathematical Programming Computation*, 1-30.
- Budiman, E., & Tejawati, A. (2018). Efficiency and Reliability Performance's of the Bioinformatics Resource Portal. In *2018 5th International Conference on Electrical Engineering, Computer Science and Informatics (EECSI)* (pp. 493-498).
- Cho, S., & Jang, J. (2016). Quantitative evaluation index derivation of the software based on ISO/IEC 9126-2 metrics. *Journal of Applied Reliability*, 16(2), 134-146.
- Djouab, R., & Bari, M. (2019). An ISO 9126 based quality model for the e-learning systems. *International journal of information and education technology*, 6(5), 370.
- Dolinina, O. N., Kushnikov, V. A., Pechenkin, V. V., & Rezchikov, A. F. (2018). The way of quality management of the decision making software systems development. In *Computer Science On-line Conference* (pp. 90-98). Springer, Cham.
- Farid, S., Ahmad, R., Alam, M., Akbar, A., & Chang, V. (2018). A sustainable quality assessment model for the information delivery in E-learning systems. *Information Discovery and Delivery*, 46(1), 1-25.
- Gerald, B. (2018). A brief review of independent, dependent and one sample t-test. *International journal of applied mathematics and theoretical physics*, 4(2), 50-54.
- Gil, L. B. C., & Hernández, M. (2018). The usability and accessibility as quality factors of a secure web product. *International Journal of Applied Engineering Research*, 13(23), 16288-16294.
- Gupta, D. (2021). An empirical study of predictive model for website quality analytics using dataset of different domains of websites. *Recent Advances in Computer Science and Communications (Formerly: Recent Patents on Computer Science)*, 14(4), 995-1007.
- ISO, I. (2001). *IEC 9126: 2001-Software engineering, product quality—Part 1: Quality model*. Geneva: International Organization for Standardization.
- Kakucha, W., Simba, F., & Anwar, A. (2018). Effects of Organization Structure on Strategic Change Management in Mombasa County Government. *Journal of Public Policy & Governance*, 2(1).
- Kapferer, J. N., & Valette-Florence, P. (2021). Which consumers believe luxury must be expensive and why? A cross-cultural comparison of motivations. *Journal of Business Research*, 132, 301-313.
- Kaur, G., & Pruthi, J. (2022). A Study of Agile-Based Approaches to Improve Software Quality. *International Journal of Computer and Systems Engineering*, 16(5), 158-163.
- KOSGEY, J. K. K. (2017). *An evaluation model for determining quality in academic websites* (Doctoral dissertation, COHES-JKUAT).
- Lami, G. (2017). *Quality Evaluation Framework For Ethiopian Healthcare Websites* (Doctoral dissertation).
- Luna, E. R., Begines, J. M. S., Rivero, J. M., Morales, L., Enríquez, J. G., & Rossi, G. (2018). Challenges for the adoption of model-driven web engineering approaches in industry. *Journal of Web Engineering*, 183-205.

Pamungkas, P. D. A. (2018). Library Information System Audit Senayan Library Management System (SLiMS) Using ISO 9126. arXiv preprint arXiv:1808.07234.

Paredes, R. K., & Hernandez, A. A. (2020). Designing an adaptive bandwidth management for higher education institutions. arXiv preprint arXiv:2012.12362.

Pilipović, D., & Simeunović, D. (2021). The Quality of Software Metrics. JITA-APEIRON, 21(1), 61-65.

Poperehnyak, S., & Vecherkovskaya, A. (2019, September). Modeling ontologies in software testing. In 2019 IEEE 14th international conference on computer sciences and information technologies (CSIT) (Vol. 3, pp. 236-239). IEEE.