



Evaluating the Developed Automated Grading System (AutoGrade) for Academic Data Management Based on ISO 9126 Quality Characteristics: Insights from Sta. Margarita National High School, Philippines

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Aim: This study evaluated the implementation of the Automated Grading System (AutoGrade), a centralized academic data management platform designed to streamline grade reporting and computation at Sta. Margarita National High School. Developed through the Rapid Application Development (RAD) model, the system integrated automated grading features to reduce manual workload and minimize human error. Its performance was assessed using the ISO 9126 software quality framework, focusing on functionality, reliability, usability, efficiency, maintainability, and portability.

Methodology: The study employed descriptive statistics (mean, median, and mode) to analyze grading time, error rates, frequency of system use, and user satisfaction. Input from 14 Senior High School teachers and 151 students guided system design and evaluation, while the iterative RAD model ensured continuous user engagement throughout development and implementation.

Results: Findings revealed that AutoGrade significantly improved grading speed and accuracy, reduced computational errors, and enhanced transparency in academic reporting. Users reported high satisfaction levels, particularly in usability and efficiency, while validation and feedback processes became more reliable and timely.

Conclusion: The Automated Grading System (AutoGrade) demonstrated strong alignment with ISO 9126 quality standards, delivering consistent performance across varied platforms and contexts. Its success highlights the value of user-centered design and provides a scalable model for academic data management in secondary education.

Keywords: Rapid Application Development (RAD), ISO 9126, Automated Grading System, Academic Data Management

INTRODUCTION

Teachers and educators used their professional judgment when assessing, evaluating, and recording grades. It is gathering and assessing data regarding students' performance or accomplishments over a predetermined time frame, such as nine weeks, a semester, or a whole school year. This procedure transforms a variety of descriptive data and performance metrics into grades or marks that provide an overview of the achievements of the students (Guskey & Pollio, 2021). Good academic data management in educational administration is of prime importance, especially in ensuring the accuracy, efficiency, and timeliness of the computation and reporting, both internally and externally. More often than not, schools like Sta. Margarita National High School relies on a manual processing system and fragmented tools for the operation of its grade management system. This would not only open more opportunities for errors but would also require much time and effort from teachers and administrative staff, which could have been better spent on core educational activities.

The integration of digital technologies within Philippine schools and educational institutions has significantly enhanced administrative efficiency, especially in the management of student data (Grepon et al., 2021; Los Baños et al., 2023). A pivotal advancement in this domain was the Department of Education's launch of the Learners





reporting. Also, most available solutions focus solely on digitization without considering the broader effect on administrative efficiency, data integrity, and user satisfaction. Hence, the study.

Conceptual Framework

The figure below shows the Rapid Application Development (RAD) Model used in the study detailing the incremental software development process that emphasizes quick prototyping, user feedback, and iterative refinement over extensive upfront planning in relation to the use and development of the AutoGrade System.

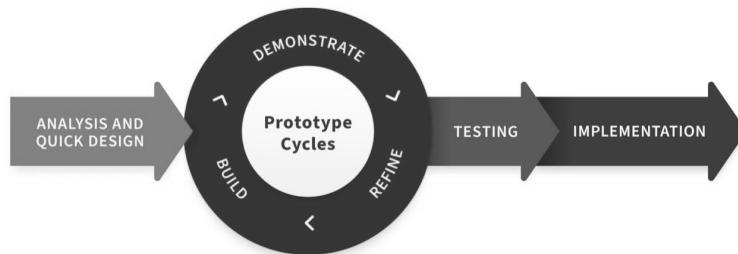


Figure 1. RAD Model in AutoGrade Development



Figure 2. ISO 9126 Compliance Framework in AutoGrade System

Review of Related Literature and Studies (RRLS)

Digitalization in the Department of Education (DepEd)

The implementation of digitalization efforts such as the Learners Information System (LIS) by the Department of Education (DepEd) in the Philippines aims to enhance educational governance and streamline administrative processes. While the system shows promise in improving record-keeping and reducing workloads, it faces significant challenges, particularly in rural areas.

In fact, LIS has been shown to enhance record-keeping and reduce administrative burdens in schools. Many rural schools struggle with inadequate IT infrastructure, leading to technical failures and high maintenance costs (Bete & Collera, 2025). Moreover, the introduction of automated systems for managing learners' records has led to significant time savings and reduced errors in administrative tasks. DepEd's guidelines for standardized procedures



have improved the efficiency of school registrars, promoting a more organized approach to student data management (Bagacay et al., 2024).

Despite these advancements, the LIS's effectiveness is hindered by infrastructural limitations and the need for ongoing training and support for educators. Addressing these challenges is crucial for maximizing the potential of LIS in achieving equitable educational outcomes across the Philippines.

Pathways for Digitalization in the Department of Education (DepEd)

The future of digitalization in the Department of Education in the Philippines is poised for significant transformation, driven by the integration of information and communication technology (ICT) and the demands of the Fourth Industrial Revolution (IR 4.0). This evolution necessitates a comprehensive approach to address existing challenges while leveraging opportunities for enhancing educational outcomes.

The education system must align its curriculum with international standards and emphasize digital literacy to prepare students for a competitive global landscape. Addressing infrastructure deficits, such as poor internet connectivity and a lack of devices, is crucial for equitable access to digital education, particularly in underserved areas (Kunjiapu et al., 2025). Future educational spaces should promote personalized and experiential learning, encouraging lifelong education and critical thinking skills (Maming et al., 2024).

While the potential for digitalization in education is promising, it is essential to recognize the systemic barriers that may hinder progress, such as socio-economic disparities and inadequate training for educators. Addressing these challenges will be vital for realizing the full benefits of digitalization in the Philippine education system.

Statement of the Problem

Despite the Department of Education's efforts to digitize grading processes through the Learners Information System (LIS) and Electronic Class Record (ECR), Philippine schools continue to face challenges in maintaining accurate, efficient, and secure academic data management. These systems remain decentralized, susceptible to errors, and limited in accessibility. In Sta. Margarita National High School, the reliance on manual and fragmented grading systems hinders productivity, increases administrative workload, and risks data integrity. Furthermore, no systematic evaluation has been conducted on the effectiveness of automated grading systems in secondary schools using internationally recognized software quality standards. This gap underscores the need to develop and assess an Automated Grading System (AutoGrade) based on the ISO 9126 framework to ensure functionality, reliability, usability, efficiency, maintainability, and portability.

Research Objectives

The study sought to assess the fully integrated and centralized academic data management system known as the Automated Grading System (AutoGrade). Specifically, it aimed to:

1. To evaluate the AutoGrade system according to the following software quality attributes:
 - a. functionality,
 - b. reliability,
 - c. usability,
 - d. efficiency,
 - e. maintainability, and
 - f. portability.
2. To generate actionable insights to align system design and implementation with the specific needs of Sta. Margarita National High School, under the Department of Education – Samar Division, Philippines.

Research Questions

1. How does the Automated Grading System (AutoGrade) perform in terms of the following software quality attributes:
 - a. functionality,
 - b. reliability,
 - c. usability,
 - d. efficiency,
 - e. maintainability, and
 - f. portability?



2. What actionable insights can be generated to align system design and implementation with the specific needs of Sta. Margarita National High School, Samar Division, Philippines?

METHODS

Research Design

This study emphasized a user-centered approach to evaluating the Automated Grading System (AutoGrade) using a quantitative approach from a technology education perspective. The Rapid Application Development (RAD) model was also utilized as its basis, and ISO 9126. The iterative and user-centered approach of Rapid Application Development (RAD) directs the ongoing user engagement on the design and implementation stages. This iterative method simplifies early feedback and revisions, resulting in a system that more effectively addresses the specific needs and expectations of educators, students, and administrators.

Furthermore, the model includes six essential characteristics: functionality, reliability, usability, efficiency, maintainability, and portability. The characteristics function as guiding principles during the development process, ensuring the system effectively meets user needs, operates reliably and without errors, is user-friendly and easy to navigate, optimizes resource use, is adaptable and maintainable, and is compatible with diverse environments and platforms. The research utilized a quantitative method and a developmental research design.

Population and Sampling

In keeping with the user-centered and iterative principles of the Rapid Application Development (RAD) model, this study purposively selected fourteen (14) Senior High School (SHS) teachers at Sta. Margarita National High School. They served as the primary end-user of the Automated Grading System (AutoGrade). Their inclusion was strategic, as teachers are directly responsible for managing and executing the grading process, making their feedback essential in shaping a system that aligns with real-world educational workflows. This purposive sampling ensured that insights gathered were both relevant and practical, supporting the RAD model's emphasis on continuous user engagement during design and implementation. Although the abstract referenced 151 students, they were not included as direct respondents in the system evaluation. This exclusion was deliberate, as the study focused on assessing usability and functionality from the educator's perspective. Nevertheless, students' needs were considered indirectly through design features aimed at improving feedback accuracy and turnaround time, consistent with the ISO 9126 framework for software quality.

Data Collection

Before data collection, Sta. Margarita National High School teachers, students, and all participants were invited through a voluntary participation process. Informed consent was obtained, ensuring that respondents understood the study's purpose, their rights, and the confidentiality of their responses. Moreover, during data collection, to promote completeness and reliability, survey instruments were clearly structured, and system logs were used to track engagement and response patterns. Partial responses were accepted to respect participant autonomy, while metadata such as time stamps and completion rates helped validate the integrity of the data. After data collection, the researcher assured the participants that their responses would be treated with utmost confidentiality and anonymity, and shall only be used for research purposes only.

Instrument

The study employed a multi-method quantitative approach in the development phase and in the evaluation phase of the study, integrating Likert-scale surveys, system usage logs, and performance metrics to evaluate the Automated Grading System (AutoGrade). The Likert scale enabled respondents to express levels of agreement with statements related to usability, feature satisfaction, and overall experience, providing measurable insights into user perceptions. These data sources collectively informed the assessment of system efficiency, effectiveness, and usability, and guided recommendations tailored to the specific needs of Sta. Margarita National High School under the Department of Education – Samar Division.

Moreover, the instrument was validated by a pool of experts during the proposal of the study, and before obtaining the ethical clearance certificate of Samar State University (SSU), through the Institutional Human Research Ethics Committee (IHREC).

Statistical Treatment of Data



The data were collected from fourteen (14) teachers of Sta. Margarita National High School, Division of Samar, Philippines and underwent a thorough statistical analysis to assess the impact of the centralized and automated grading system on several aspects of the academic process, in alignment with the quality characteristics outlined in ISO 9126.

Descriptive statistics, specifically mean, median, and mode, were used to summarize and describe key variables, such as grading times, error rates, system usage frequency, and user satisfaction ratings.

The mean were used to determine the average values for each variable, providing a central measure of tendency. The median was employed to assess the middle value of data, offering insights into distributions and central tendency, particularly in the case of skewed data. The mode were used to identify the most frequently occurring values, helping to highlight the common trends and issues.

These measures were very crucial for evaluating efficiency, reliability, and usability. Given the small sample size of 14 teachers, these descriptive statistics provided a summarized overview of the data, allowing for the identification of patterns related to the system's functionality, reliability, and usability compared to the traditional manual systems. The results will be presented through tables, facilitating precise and concise interpretations and aiding in the communication of findings related to software quality and users' experience.

Ethical Considerations

Informed consent was obtained from all participants, ensuring confidentiality and voluntary participation. The study emphasized ethical data handling and proper reporting, with all information gathered treated with strict confidentiality and used solely for research purposes only. Lastly, the study conformed with the ethical standards by securing ethical clearance from the Samar State University (SSU) Institutional Human Research Ethics Committee (IHREC) before the commencement of the research.

RESULTS and DISCUSSION

This section provides the tables summarizing the study's salient findings, with corresponding discussions elaborated in the ensuing sections.

Evaluation of Developed Automated Grading System

The evaluation of the Automated Grading System (AutoGrade) was conducted based on the ISO 9126 Software Quality Model, which assesses software products based on six key attributes: Functionality, Reliability, Usability, Efficiency, Maintainability, and Portability. Additionally, a seventh category, General Functionality & User Needs, was included to evaluate how well the system meets the specific needs of educators.

The respondents of this evaluation were faculty members from the Senior High School (SHS) Department of Santa Margarita National High School (SMNHS). Out of the 14 faculty members, a total of 10 respondents participated in the survey, resulting in a 71.43% response rate. This level of participation provides a solid foundation for evaluating the system's performance and effectiveness in real-world academic settings.

A five-point Likert scale were used to analyze the responses. The Likert Scale is interpreted as follows: a scale value of 5 represents "Strongly Agree" (SA), 4 represents "Agree" (A), 3 represents "Neutral" (N), 2 represents "Disagree" (D), and 1 represents "Strongly Disagree" (SD). The weighted mean for each evaluation category was computed and interpreted based on this scale.

Functionality. Functionality refers to how well the AutoGrade System performs its intended tasks, such as calculating grades accurately, generating reports, and meeting the needs of teachers and administrators.

Table 1. Functionality of the AutoGrade System

Indicators	RESPONSES					WEIGHTED MEAN
	5 (SA)	4 (A)	3 (N)	2 (D)	1 (SD)	
Functionality						
1. The system accurately calculates grades.	3	6		1		4.2



2. The system generates reports efficiently.	5	3	2			4.3
3. The system meets the specific needs of teachers and administrators.	6	3	1			4.5
4. The system provides the necessary features for managing student grades.	5	2	3			4.2
5. The system allows for easy entry and management of student scores.	6	4				4.6
6. The system provides different calculation methods for grading.	5	3	2			4.3
Grand Mean						4.35

The AutoGrade system is highly functional, with an overall weighted mean of 4.3. The highest-rated indicator, "the system allows for easy entry and management of student scores (4.6)," suggests that users find the system convenient for inputting grades. However, minor improvements in calculation accuracy and report generation could enhance functionality.

Reliability. Reliability assesses the stability and dependability of the system in handling data accurately and securely.

Table 2. Reliability of the AutoGrade System

Indicators	RESPONSES					WEIGHTED MEAN
	5 (SA)	4 (A)	3 (N)	2 (D)	1 (SD)	
Reliability						
1. The system is stable and reliable in its operation.	5	5				4.5
2. The system is free from errors and data integrity issues.	2	4	4			3.8
3. The system can be depended upon to perform its functions consistently.	4	3	3			4.1
4. The system ensures the security and privacy of student data.	4	1	4	1		3.8
5. The system has a backup and recovery mechanism in case of failures.	2	4	4			3.8
Grand Mean						4.0

The system achieved a weighted mean of 4.0, indicating a generally reliable performance. While stability and dependability received high ratings (4.5 and 4.1), areas such as data integrity, security, and backup mechanisms (3.8) need enhancement to ensure greater reliability and user trust.



Usability. Usability refers to how users navigate the AutoGrade system; users are the teachers.

Table 3. Usability of the AutoGrade System

Indicators	USABILITY					WEIGHTED MEAN
	5 (SA)	4 (A)	3 (N)	2 (D)	1 (SD)	
Usability						
1. The system interface is user-friendly and easy to navigate.	6	4				4.6
2. The system is easy to learn and use for teachers and administrators.	7	3				4.7
3. The system provides clear instructions and helpful guidance.	5	5				4.5
4. The overall user experience is satisfactory.	6	4				4.6
5. The system provides an intuitive and engaging user experience.	4	4	2			4.2
Grand Mean						4.52

The results show a generally positive user experience, with the highest weighted mean of 4.7 for ease of learning and use. The system's user-friendliness and overall experience both scored 4.6, indicating that users find it intuitive and accessible. Additionally, the clarity of instructions received a rating of 4.5, reflecting the system's effectiveness in guiding users.

Efficiency. Efficiency refers to how efficiently the AutoGrade system performs its tasks.

Table 4. Efficiency of the AutoGrade System

Indicators	RESPONSES					WEIGHTED MEAN
	5 (SA)	4 (A)	3 (N)	2 (D)	1 (SD)	
Efficiency						
1. The system performs tasks quickly and efficiently.	6	2	2			4.4
2. The system optimizes resource utilization effectively.	3	5	2			4.1
3. The system is responsive and does not cause delays.	3	5	2			4.1
4. The system reduces the time spent on grading tasks compared to the manual process.	5	4	1			4.4
5. The system improves the overall workflow of managing and calculating grades.	4	4	2			4.2



Grand Mean						4.24
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The results indicate that the AutoGrade System is perceived as efficient, with most responses in the "Agree" and "Strongly Agree" categories. No users expressed disagreement, but some provided neutral responses, particularly regarding responsiveness and resource utilization. These findings suggest that while the system effectively enhances grading efficiency, further refinements could improve its overall performance and user satisfaction.

Maintainability. Table 5 evaluates the maintainability of the AutoGrade System based on five key indicators: ease of maintenance, issue resolution, adaptability, modular design, and system integration.

Table 5. Maintainability of the AutoGrade System

Indicators	RESPONSES					WEIGHTED MEAN
	5 (SA)	4 (A)	3 (N)	2 (D)	1 (SD)	
Maintainability						
1. The system is easy to maintain and update.	6	2	3			4.27
2. Bugs or issues can be resolved easily with the system.	4	2	4			4.0
3. The system is adaptable to future modifications or enhancements.	4	4	2			4.2
4. The system is designed in a modular and well-documented manner.	8	1	1			4.7
5. The system can be easily integrated with other school systems or platforms.	7	3				4.7
Grand Mean						4.37

The results indicate that the AutoGrade System is generally considered maintainable, with most users agreeing that it is easy to update, modify, and integrate with other platforms. However, the lower rating for issue resolution suggests that improvements in debugging support or troubleshooting features could further enhance system maintainability. These findings highlight the system's strengths while also identifying areas for potential refinement.



Portability. Table 6 presents an evaluation of the portability of the AutoGrade System based on user responses. It assesses five key indicators: compatibility with various environments, ease of transfer or deployment, seamless functionality across different devices, support for multiple operating systems and web browsers, and scalability for handling an increasing number of users or data.

Table 6. Portability of the AutoGrade System

Indicators	RESPONSES					WEIGHTED MEAN
	5 (SA)	4 (A)	3 (N)	2 (D)	1 (SD)	
Portability						
1. The system is compatible with various environments and platforms.	3	7				4.3
2. The system can be easily transferred or deployed to different settings.	5	4	1			4.4
3. The system functions seamlessly across different devices (computers, tablets, etc.).	6	3	1			4.5
4. The system supports different operating systems and web browsers.	3	6	1			4.2
5. The system can be easily scaled to accommodate a growing number of users or data.	4	5	1			4.3
Grand Mean						4.34

The highest-rated indicator, with a weighted mean of 4.5, reflects the system's ability to function smoothly across different devices such as computers and tablets. The lowest-rated indicator, at 4.2, pertains to the system's support for different operating systems and web browsers, suggesting a minor area for improvement. This indicates that the AutoGrade System is highly portable, as most responses fall within the "Agree" and "Strongly Agree" categories. Users particularly appreciated its adaptability to different devices and ease of deployment, with no significant negative feedback. The results suggest that the system effectively meets portability requirements, although slight improvements in cross-platform compatibility could further enhance its usability.

Anchored in the ISO 9126 quality model, the system's evaluation covers usability, reliability, efficiency, and functionality. While usability remains crucial for learnability and operability, gaps like the absence of user assistance features reveal areas for enhancement. Efficiency, closely tied to resource optimization, directly influences user satisfaction, highlighting a continued need for performance refinement across systems.

Moreover, teacher evaluations have shown varying usability scores, with some systems lacking user assistance features, indicating a need for improvement (Rochimah et al., 2015). Moreover, Efficiency measures the system's performance relative to resource usage. Studies have highlighted the importance of optimizing efficiency to enhance overall user satisfaction (Budiman et al., 2018).

Conclusions

Based on the findings, the study concludes that the AutoGrade system successfully met the standards outlined in the ISO 9126 quality model, particularly from the perspective of end-user experience. The system demonstrated strong performance across key quality dimensions such as functionality, efficiency, reliability, usability, and portability—indicating its overall effectiveness in managing academic grading processes. More specifically, users noted how the system greatly facilitated core grading operations, including the quick recording of scores, seamless validation, and consistent checking and rechecking of data for accuracy. These features collectively minimized delays and reduced the likelihood of human error, creating a more streamlined workflow for educators. Additionally, its built-in feedback mechanism allowed teachers to efficiently communicate assessment results to students, promoting transparency and timely academic support. Taken together, these capabilities highlight AutoGrade's potential to enhance institutional grading systems while upholding internationally recognized standards of software quality.

Taken together, these capabilities highlight AutoGrade's potential to enhance institutional grading systems while upholding internationally recognized standards of software quality. Beyond its technical merits, the study offers a material contribution to the academic community by presenting a novel approach to automating grading workflows—an area often overlooked in educational technology research. By demonstrating how software quality models can be meaningfully applied to real-world academic systems, the research provides insights that may inform future innovations in assessment design, institutional efficiency, and digital pedagogy. Thus, the findings not only validate AutoGrade's effectiveness but also underscore its relevance to broader conversations in educational research and practice.

Recommendations

To fully leverage emerging technologies in the classroom, such as the Developed AutoGrade system, the Department of Education (DepEd) may initiate targeted training workshops for teachers and administrators to enhance their use of the platform's grading, feedback, and data validation features to aid teachers in the teaching-learning process and other similar technologies. These sessions can include hands-on demonstrations from experts for longer periods and address common user challenges and difficulties. Lastly, the system may be adapted by other schools with other students as well so that the AutoGrade system can be improved, streamlined, and promoted.

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