

Enhancing School Efficiency with A Web-Based E-Reporting System

[Peningkatan Efisiensi Sekolah dengan Sistem E-Reporting Berbasis Web]

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ABSTRACT

The education sector, a crucial component of the service industry, faced significant challenges in improving operational optimization, particularly in administrative processes. Managing grades and preparing report cards often presented a substantial workload for educators, especially in SMA Santa Patricia. This study aimed to develop an integrated web-based e-Report system to optimize operations by addressing ineffectiveness, inefficiencies, and human error. The system was developed using the System Development Life Cycle (SDLC) framework with a prototyping model. Usability testing through the Computer System Usability Questionnaire (CSUQ) demonstrated improvements, including a 12% increase in effectiveness and an 8% enhancement in efficiency. Additionally, paired T-test results revealed notable gains in system usefulness (14%), information quality (13%), interface quality (14%), and overall system performance (13%) compared to the previous Microsoft Excel-based system. These results underscore the critical role of integrated systems in streamlining operations within the service industry.

Keywords : *administrative processes; report card management; school operations; usability testing; web-based system*

ABSTRAK

Sektor pendidikan, sebagai bagian penting dari industri jasa, menghadapi tantangan besar dalam mengoptimalkan operasional, khususnya dalam proses administrasi. Pengelolaan nilai dan penyusunan rapor sering kali menjadi beban kerja yang cukup besar bagi para pendidik, terutama di SMA Santa Patricia. Penelitian ini bertujuan untuk mengembangkan sistem e-Rapor berbasis web yang terintegrasi guna mengoptimalkan operasional dengan mengatasi ketidakefisienan, ketidakefektifan, dan kesalahan manusia. Sistem ini dikembangkan menggunakan kerangka kerja System Development Life Cycle (SDLC) dengan model prototyping. Uji kegunaan yang dilakukan melalui Computer System Usability Questionnaire (CSUQ) menunjukkan adanya peningkatan, termasuk peningkatan efektivitas sebesar 12% dan efisiensi sebesar 8%. Selain itu, hasil paired T-test mengungkapkan peningkatan yang signifikan dalam kegunaan sistem (14%), kualitas informasi (13%), kualitas antarmuka (14%), dan kinerja sistem secara keseluruhan (13%) dibandingkan dengan sistem sebelumnya yang berbasis Microsoft Excel. Hasil ini menegaskan peran penting sistem terintegrasi dalam menyederhanakan operasional di sektor jasa.

Kata kunci : *manajemen rapor; operasi sekolah; pengujian kegunaan; proses administrasi; sistem berbasis web*

INTRODUCTION

In recent years, the increasing complexity of administrative tasks within educational institutions has presented significant challenges for educators. Beyond their primary responsibilities of teaching, mentoring, and guiding students, teachers are frequently burdened with additional tasks, such as compiling student performance reports, managing academic data, documenting extracurricular activities, and preparing project evaluations. These responsibilities often demand significant time and energy, detracting from their ability to focus on delivering high-quality learning experiences (Rosyada et al., 2024). Moreover, the reliance on manual processes, such as using separate spreadsheet templates for different roles, exacerbates ineffectiveness, inefficiencies, and increases the likelihood of human error, including data mismatches, formula errors, and misplaced entries. The case of SMA Santa Patricia exemplifies these challenges, as the school currently relies on manual methods for processing student performance data and generating comprehensive, ready-to-print academic reports. Teachers, many of whom hold multiple roles, must independently manage and consolidate data using Microsoft Excel templates. This decentralized approach creates bottlenecks in workflow, delays in

report preparation, and frequent errors due to the repetitive and error-prone nature of manual data handling. Such ineffectiveness and inefficiencies not only increase the administrative burden on educators but also impact the overall quality and accuracy of student performance reporting. (Mbawala et al., 2024) The growing demand for efficient and accurate data processing in education underscores the importance of adopting technology-driven solutions (Febriyanto et al., 2020).

Previous research has shown that leveraging information systems, such as e-Reporting system, can streamline administrative processes, improve data accuracy, and reduce human error, thereby enabling educators to allocate more time to instructional activities (Forrester, 2019). Technology has driven an educational revolution, shifting from traditional methods to modern and more effective learning approaches. In educational organization management, optimizing technology is crucial for enhancing effectiveness and efficiency in data and information management (Fadillah et al., 2024). Technology, which enables system integration, in particular have been demonstrated to be effective solutions due to their ability to process data accurately and efficiently, allowing educators and educational staff to save time and effort in

managing administrative tasks within schools (Forrester, 2019).

This study aims to develop an integrated e-Reporting system, which consolidates various processes involved in data management and academic reporting into a single, web-based platform. The proposed system will automate key tasks, such as inputting, processing, and consolidating student performance data, ensuring that the final reports are accurate and compliant with institutional standards. By simplifying complex workflows and reducing reliance on manual methods, the system is expected to enhance the effectiveness, efficiency, and accuracy of administrative activities while minimizing errors. The significance of this research lies in its potential to address persistent administrative challenges in education by introducing an innovative, technology-based solution. The proposed e-Reporting system not only provides a practical tool for SMA Santa Patricia but also serves as a

model for other institutions seeking to optimize their data management and reporting processes. By reducing administrative workloads, enhancing operational efficiency, improving effectiveness, and minimizing human error, this study contributes to the broader effort of empowering educators to focus on their primary mission: delivering high-quality education.

RESEARCH METHOD

This study adopted the Systems Development Life Cycle (SDLC) with a prototyping model (Fig. 1) as the system development approach, which was carried out in four main stages: planning, analysis, design, and implementation (Dennis et al., 2012) during October to November 2024. Additionally, a quantitative research methodology was employed during the implementation stage to evaluate the improvements achieved by the proposed e-Reporting system.

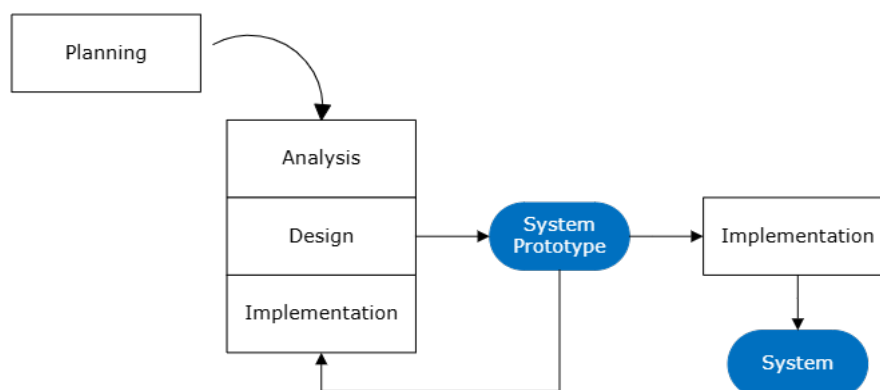


Figure 1. Prototyping Model of SDLC

Creating System Prototype

The first stage, planning, aimed to understand the necessity of the e-Reporting system and outline how it should be developed. A system request was created, and a feasibility study was conducted to evaluate both technical and organizational feasibility. Following this, a prototyping model was employed to develop a minimal feature system prototype based on the gathered requirements. This iterative approach bridged the gap between the school's expectations and the system design, providing clearer feedback as users initially struggled to articulate their requirements during the planning phase. As a result of time constraints, the analysis and design stages of the prototype were carried out by a third-party developer, while this study focused on analyzing, refining the design, and implementing the proposed system.

Development of the Proposed System

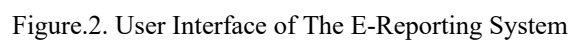
Based on user feedback from the prototype, the proposed system was reanalyzed, redesigned, and implemented to address shortcomings and incorporate additional features. The analysis stage identified the system's intended users, its functionality, and its operational environment. Business processes and rules from the existing system were modeled

using tools such as business process model & notation (BPMN), use case diagram, context diagram, data flow diagrams (The DFD consist of 24 processes and 30 datastores), and entity relationship diagrams (ERD) (Dennis et al., 2012). A comparison between the previous unintegrated system (current system) and the e-Reporting system (proposed system) was conducted to highlight areas needing improvement.

The design stage focused on defining the operational aspects of the system, including hardware, software, network infrastructure, user interfaces, forms, and reports. In the implementation stage, the system was developed using PHP (Laravel framework) for backend development, HTML and Javascript for the frontend, and MySQL for the database, supported by Apache as the web server. Functional testing, specifically black-box testing, was conducted to validate the system's performance, involving all the full-time teachers and educational staffs in SMA Santa Patricia.

This e-Reporting system is developed as a web-based system because it offers greater accessibility, flexibility, and efficiency compared to traditional desktop-based solutions as Fig. 2. A web-based approach allows users to access the system anytime and from any location with an internet

data inconsistencies. By leveraging these advantages, the e-Reporting system enhances operational efficiency, streamlines administrative tasks, and improves the overall accuracy and usability of academic reporting within educational institutions.



The improvement resulting from the proposed web-based e-Reporting system was evaluated through a comparative analysis of the current system and the proposed system using the Computer System Usability Questionnaire (CSUQ). The CSUQ, a standardized instrument, assessed overall performance and three key performance indicators, including System Usefulness (SysUse), Information Quality (InfoQual), and Interface Quality (IntQual), using a 7-point Likert scale, where 1 indicated "strongly disagree" and 7 indicated "strongly agree" (Sitorus et al., 2023). The list of CSUQ questions is provided in Table 1 (Lewis, 1995).

Indicator	Code	Statement	
Overall	S1	Overall, I am satisfied with how easy it is to use this system.	
	S2	It is simple to use this system.	
	S3	I can effectively complete my work using this system.	
	S4	I am able to complete my work quickly using this system.	
	S5	I am able to efficiently complete my work using this system.	
	S6	I feel comfortable using this system.	
	S7	It was easy to learn to use this system.	
	S8	I believe I became productive quickly using this system.	
	InfoQual	S9	The system gives error messages that clearly tell me how to fix problems.
		S10	Whenever I make a mistake using the system, I recover easily and quickly.
		S11	The information provided with this system is clear.

	S12	It is easy to find the information I need.
	S13	The information provided with the system is easy to understand.
	S14	The information is effective in helping me complete my work.
	S15	The organization of information on the system screens is clear.
IntQual	S16	The interface of this system is pleasant.
	S17	I like using the interface of this system.
	S18	This system has all the functions and capabilities I expect it to have.
	S19	Overall, I am satisfied with this system

The questionnaire was completed by 13 participants, including teachers and administrative staff, who had functionally tested the system. To statistically evaluate the improvements, a paired t-test was performed to compare the CSUQ results of the previous system and the proposed system, with a significance level (α) set at 0.05. The hypothesis for the paired t-test was as follows (Nuryadi et al., 2017):

1. If the significance value (Sig.) is < 0.05 , the null hypothesis (H_0) is rejected, indicating a significant difference between the two systems.
2. If the significance value (Sig.) is > 0.05 , the null hypothesis (H_0) fails to be rejected, indicating no significant difference between the two systems.

RESULT AND DISCUSSION

Blackbox Testing

Black-box testing, also known as specification-based testing, is a software testing method where the internal structure, implementation, or design of the system is not known to the tester. Instead, the system is evaluated solely based on its inputs and expected outputs, ensuring that functional requirements are met. This approach treats the system as a "black box," focusing on whether the software behaves as intended without considering its internal workings (Jorgensen, 2014).

The functional testing of the system using black-box testing demonstrated that all features of the integrated web-based e-Reporting system operated successfully. Table 2 show that a total of 26 key features were tested and were confirmed to have passed (P) the evaluation, indicating that the system met the expected functional requirements during the trial phase.

Table 2. Blackbox Testing Result

No	Admin	Status	Teacher	Status
1	Log in	P	Log In	P
2	Manage school data	P		
3	Manage academic year	P		
4	Manage admin data	P		
5	Manage teacher data	P		

6	Manage class data	P		
7	Manage student data	P	Manage student data in particular class (homeroom teacher)	P
8	Manage subject data	P		
9	Manage lesson data	P		
10			Manage learning objectives (subject teachers)	P
11			Manage students' grades (subject teacher)	P
12	Access grade ledger	P	Access grade ledger (homeroom teacher)	P
13		P	Manage attendance (homeroom teacher)	P
14		P	Manage students' development notes (homeroom teacher)	P
15	Manage extracurricular data	P		
16		P	Manage extracurricular members (extracurricular mentor)	P
17		P	Manage students' extracurricular grades (extracurricular mentor)	P
18	Manage target achievement data for P5 profile	P		
19	Manage P5 projects	P		
20	Manage target achievement for P5 projects	P		
21	Manage P5 groups	P		
22	Manage P5 group members	P		
23	Manage selected P5 group projects	P		
24		P	Manages P5 grades (P5 mentor)	P
25	Download ready-to-print report cards	P	Download ready-to-print report cards (homeroom teacher)	P
26	Update profile account	P	Update profile account	P

Effectiveness and Efficiency Comparison

The increase in effectiveness and efficiency in the grading process and report generation was demonstrated by the elimination of several manual business processes through the implementation of the integrated web-based e-Reporting system. The system automated previously time-consuming tasks, such as preparing

and distributing assessment templates, manual data entry using copy & paste across multiple non-integrated Microsoft Excel files, final grade processing and recapitulation, and the generation of ready-to-print reports. As a result, resources such as time and effort spent by users were significantly reduced.

Additionally, the questionnaire results further confirmed these improvements. The use of the integrated web-based e-Reporting system led to an increase in the average effectiveness score (S3) from 5.85 to 6.54 (a 12% improvement) and an increase in the average efficiency score (S5) from 5.92 to 6.38 (an 8% improvement). The simplification of business processes through system integration also contributed to minimizing human errors in grading and report generation, ensuring higher accuracy and reliability in the final outputs.

Paired T-Test Result

The results of the Paired Sample T-Test, as summarized in Tables 3, demonstrate statistically significant differences between the current system and the proposed system across four key performance indicators: Overall, System Usefulness (SysUse), Information Quality (InfoQual), and Interface Quality (IntQual). Each test yielded a two-tailed significance value ($p < 0.001$), which is well below the standard threshold of 0.05. These results indicate that the null hypothesis (H_0), which posits no significant difference between the two systems, must be rejected for all four indicators. Instead, the alternative hypothesis (H_1), which asserts significant differences, is supported.

Table 3. Paired T-Test Result

Indicator	Comparison	n	Descriptive Statistics		Paired T-test		
			Mean	Std. Dev.	t	df	Sig. (2-sided)
Overall	Current system	19	5.76	0.13	-19.70	18	<0.001*
	Proposed system		6.53	0.09			
SysUse	Current system	8	5.74	0.107	-10.75	7	<0.001*
	Proposed system		6.52	0.124			
InfoQual	Current system	7	5.78	0.18	-11.31	6	<0.001*
	Proposed system		6.54	0.07			
IntQual	Current system	3	5.77	0.08	-11.29	2	0.008*
	Proposed system		6.57	0.05			

* $p < 0.05$: significance level

The findings indicate that the proposed system significantly outperforms the current system across all indicators, whose improvements are reflected in the increasing of mean values. In terms of

Overall Performance, the mean score increased from 5.76 for the current system to 6.53 for the proposed system, representing a 13% improvement. This demonstrates that the proposed system

provides substantial enhancements in overall performance. Similarly, for System Usefulness (SysUse), the mean score rose from 5.74 to 6.52, showing a 14% improvement, which highlights the increased functionality and usefulness of the proposed system. In the aspect of Information Quality (InfoQual), the mean score increased from 5.78 to 6.54, reflecting a 13% improvement in the quality of the information delivered by the system. Lastly, Interface Quality (IntQual) saw the average score increase from 5.77 to 6.57, indicating a 14% improvement in the user interface, further enhancing the user experience.

These results emphasize the consistent and significant improvements across all indicators, illustrating that the proposed system provides a clear advantage over the current system in terms of overall performance, usefulness, information quality, and interface quality.

The findings from this study present more than just practical improvements at the institutional level. They also contribute valuable insight to the broader field of industrial engineering, particularly in the domain of service operational optimization, information system design, and human system integration

CONCLUSION

This study demonstrates that the proposed web-based e-Reporting system

significantly improves the grading process compared to the current Microsoft Excel-based system. Functional testing confirmed that all 26 main features work effectively, ensuring the system's reliability. The integration of automated processes has enhanced efficiency by eliminating manual tasks such as preparing templates, copying data, and calculating final grades, thereby reducing user workload and minimizing errors. Questionnaire analysis revealed notable improvements in effectiveness (12%) and efficiency (8%), highlighting the system's ability to optimize resources.

The Paired Sample T-Test results further emphasize the proposed system's superiority. Overall performance improved by 13%, with significant increases in system usefulness (14%), information quality (13%), and interface quality (14%). These findings validate the system's success in enhancing functionality, usability, and user experience.

Future research could focus on measuring tangible resources like time and cost savings, integrating historical data storage for long-term access, and adding features like automated attendance tracking to further expand the system's capabilities.

REFERENCES

- Dennis, A., Wixom, B. H., & Roth, R. M. (2012). *System analysis & design* (5th ed.). Wiley Publishing.

- Fadillah, S. I., Mukhlisin, A., Athirah, N., Jannah, M., & Arini, T. (2024). Peran teknologi dalam optimalisasi manajemen organisasi pendidikan. *Jurnal Motivasi Pendidikan dan Bahasa*, 2(3), 93–105. <https://doi.org/10.59581/jmpb-widyakarya.v2i3.3850>
- Febriyanto, E., Naufal, R. S., & Sulistiawati, S. (2020). Planning of the web-based e-Raport assessment system. *Aptisi Transactions on Technopreneurship (ATT)*, 2(1), 48–58. <https://doi.org/10.34306/att.v2i1.27>
- Forrester, V. V. (2019). School management information systems: Challenges to educational decision making in the big data era. *International Journal on Integrating Technology in Education*, 8(1), 1–11. <https://doi.org/10.5121/ijite.2019.8101>
- Jorgensen, P. C. (2014). *Software testing: A craftsman's approach* (4th ed.). CRC Press Taylor & Francis Group. Retrieved from <http://ieeexplore.ieee.org/document/6756758/>
- Lewis, J. R. (1995). IBM computer usability satisfaction questionnaires: Psychometric evaluation and instructions for use. *International Journal of Human-Computer Interaction*, 7(1), 57–78. <https://doi.org/10.1080/10447319509526110>
- Nuryadi, T. D. A., Utami, E. S., & Budiantara, M. (2017). *Buku ajar dasar-dasar statistik penelitian*.
- Mbawala, J. J., Lestari, S., & Mwakalindile, A. (2024). The impact of educational management information systems (EMIS) on effective school management in Tanzania. *Jurnal Penelitian Pendidikan IPA*, 10(4), 1878–1885. <https://doi.org/10.29303/jppipa.v10i4.7033>
- Rosyada, A., Syahada, P., & Chanifudin, C. (2024). Kurikulum Merdeka: Dampak peningkatan beban administrasi guru terhadap efektivitas pembelajaran. *Jurnal Inovasi, Evaluasi dan Pengembangan Pembelajaran (JIEPP)*, 4(2), 238–244. <https://doi.org/10.54371/jiepp.v4i2.491>
- Sitorus, Y., Astiti, S., & Setyadi, R. (2023). Evaluation of the level of usefulness of the 'Jeknyong' application using the Computer System Usability Questionnaire (CSUQ) method. *Journal of Informatics Information System Software Engineering and Applications (INISTA)*, 5(2), 92–103. <https://doi.org/10.20895/inista.v5i2.1004>
- Suryandani, F., Basori, B., & Maryono, D. (2017). Pengembangan sistem informasi akademik berbasis web sebagai sistem pengolahan nilai siswa di SMK Negeri 1 Kudus. *Jurnal Ilmiah Pendidikan Teknik dan Kejuruan*, 10(1), 71. <https://doi.org/10.20961/jiptek.v10i1.14976>