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Development of Academic Information System to Improve School Service Quality at SMK Negeri 1 Pundong

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ABSTRACT

Purpose of the study: This study aims to develop a desktop-based Academic Information System (AIS) and analyze its effect on improving school service quality at State Vocational High School 1 Pundong through integrated management of teacher data, student data, employee data, inventory, correspondence, and schedules.

Methodology: The study employed Research and Development (R&D) method with waterfall model (needs analysis, design, coding, testing). The system was developed using Borland Delphi 7 programming language and Microsoft Access database. Data were collected through unstructured interviews and needs analysis questionnaires distributed to 86 teachers and staff, as well as black box testing and performance testing by experts and users.

Main Findings: Expert testing results obtained a score of 83.75% (very good) and user testing obtained 86.81% (very good). Service Quality-based functionality testing achieved 86.33% with the highest dimension on Tangibles (89.33%). The system successfully integrated eight main menus and proved to increase service speed (95%) and ease of operation (91.25%).

Novelty/Originality of this study: The novelty of this research lies in the development of a comprehensive AIS that integrates eight school management functions into one integrated platform, as well as evaluating its impact on service quality through active user participation since the needs analysis stage, differing from previous studies that only focused on single functions such as grade management or student admission.

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1. INTRODUCTION

The rapid development of information technology in the modern era has penetrated various sectors, including the world of education, and requires institutions such as vocational schools (SMK) to adapt to improve the effectiveness of school management. State Vocational High School 1 Pundong, as a vocational education institution, should be able to utilize this technology optimally, especially in academic data management to support good governance [1]. However, initial observations found that the computers available at the school are mostly used for student practice and have not been utilized significantly to support educational services and school administration. As a result, the school does not yet have an integrated information system, so the process of searching for teacher and student data or archived letters is still done manually and is time-consuming. This

condition indicates a gap between the potential of information technology and its implementation in daily operational activities at State Vocational High School 1 Pundong.

The main problem identified was the lack of a structured school database, resulting in inefficiencies in data management. Filing student data for purposes such as scholarship verification still involves checking physical files one by one, a slow and error-prone process [2]. Furthermore, the correspondence filing system, which still uses folders, complicates the process of searching and controlling incoming and outgoing mail. More broadly, there is generally no integrated system to support the performance of teachers and staff in providing fast and accurate academic services. These three problems directly hamper efforts to improve the quality of school services to all stakeholders.

Previous research has developed numerous information systems in educational settings, such as web-based grade information systems or online PPDB systems, which have proven effective within a limited scope. These studies generally focus on specific aspects such as grade management or new student admissions. Building on this, this study offers a novel approach by developing a more comprehensive and integrated Academic Information System (AIS) [3]. The developed AIS not only covers grade data but also manages teacher, student, employee, inventory, correspondence, and various school schedules within a single platform. This system development aims to provide a comprehensive solution to data management issues at State Vocational High School 1 Pundong.

Based on an analysis of three previous studies that developed academic information systems at Muhammadiyah 1 Kemlagi Vocational School, Taman Siswa 1 Tanjung Karang Vocational School, and Loea State Vocational School 1, it was found that all of these studies still focused on the technical aspects of system development and user acceptance testing without explicitly measuring their impact on improving the quality of school services holistically [4]. These three studies also have not integrated features typical of vocational school needs such as inventory management, structured correspondence systems, and integrated data management involving all stakeholders in one interconnected platform [5]. Meanwhile, the problem at Pundong State Vocational School 1 lies in the absence of a structured database and integrated system which causes inefficiencies in managing teacher and student data, letter archives, and school inventory. This gap is what drives the need for this study to develop a comprehensive and integrated Academic Information System, which is not only oriented towards system development but also specifically designed to improve the quality of school services through speed of data access, information transparency, and efficiency of archive management. Thus, research at SMK Negeri 1 Pundong is important to fill this gap and provide real solutions to the data management problems that schools have been facing.

The novelty of this research lies in the development of a comprehensive and integrated Academic Information System (AIS) at State Vocational High School 1 Pundong, which not only covers grade data management but also integrates data management for teachers, students, employees, inventory, correspondence, and school schedules in one integrated platform. This system is specifically designed to address the school's real problems related to the lack of a structured database by prioritizing improving service quality through speed of data access, information transparency, and efficiency of archive management [6]. Thus, this research not only produces a technically functional software product, but also provides a comprehensive solution that has a real impact on educational governance and services at State Vocational High School 1 Pundong.

The urgency of this research is increasingly pressing considering that the current manual process is no longer able to keep up with the increasing complexity and volume of academic data, so that if not immediately addressed, it will increasingly hamper the quality of school services to students, teachers, parents, and other stakeholders [7]. Thus, this research not only produces a technically functional software product, but also provides a comprehensive solution that has a real impact on educational governance and services at State Vocational High School 1 Pundong. This research specifically aims to analyze needs, develop a system, test performance, and implement an AIS to improve service quality at State Vocational High School 1 Pundong. The method used is Research and Development (R&D) with a linear sequential model (waterfall), which produces a ready-to-use software product. With this system, it is expected that the performance of teachers and employees in managing academic data can improve significantly. Ultimately, the implementation of this AIS contributes to the realization of more modern, effective, and efficient school governance. Thus, this research is expected to have a real impact on improving the quality of educational services at State Vocational High School 1 Pundong.

2. RESEARCH METHOD

This study uses the Research and Development (R&D) method to produce an Academic Information System product and test its effectiveness in improving the quality of school services [8]. The development model used is the linear sequential (waterfall) model from Pressman which consists of four stages: needs analysis, design, coding, and testing. This model was chosen because of its systematic and structured approach so that it can minimize development errors. Each stage must be completed sequentially before proceeding to the next stage. This research was conducted at State Vocational High School 1 Pundong from April to October 2013.

The first stage of the research procedure is a needs analysis aimed at collecting relevant information through literature studies and field studies at State Vocational High School 1 Pundong. The field study was conducted through unstructured interviews with the Vice Principal of Public Relations and the distribution of needs analysis questionnaires to teachers and employees [9]. This activity aims to identify problems, data needs, and features that must be present in the academic information system. The second stage is system design which includes database design using Microsoft Access and user interface design. Interface design is carried out by creating a display design for each page such as login, main menu, and data menu to ensure ease of use of the system, as shown in Figure 1.

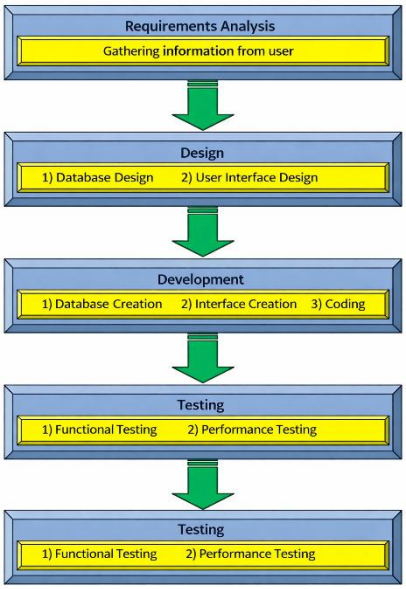

Figure 1. Academic Information System Development Model

The third stage is development or coding, where the designed database is implemented using Microsoft Access, while the system interface and logic are coded using the Borland Delphi 7 programming language [10]. This coding process translates the design into a functional application with eight main menus: teacher data, student data, employee data, correspondence, school inventory, class schedule, teacher schedule, and room schedule. The fourth stage is system testing, which is conducted in two stages: black box testing to ensure the system's functionality works as expected, and performance testing, which involves users to assess aspects of the system's design, usability, quality, and operation through questionnaires. All these stages are carried out sequentially according to the waterfall model principles to ensure the quality of the resulting product.

The subjects in this study were 86 teachers and employees at State Vocational High School 1 Pundong, consisting of 65 teachers and 21 employees as the primary users of the system [11]. The object of this research is the product of the development, namely the State Vocational High School 1 Pundong Academic Information System software, which is the main focus of the evaluation. The data sources come from primary data obtained directly from research subjects through questionnaires and interviews, as well as secondary data from library studies of various relevant literature [12]. Data collection techniques use open and closed questionnaires at the needs analysis and performance testing stages, as well as unstructured interviews at the needs analysis stage. The selection of subjects is based on their role as primary users whose assessments greatly determine the feasibility of the system being developed.

The research instruments included a needs analysis instrument, a system performance instrument (Table 2), and a system evaluation instrument based on the Service Quality dimension [13]. Data were analyzed descriptively quantitatively by converting the total score to qualitative data using a scale of 5. The percentage of system feasibility was calculated using the formula P="data collection score" / "ideal score" × 100% [14]. The percentage results were used to determine the product feasibility category. This analysis also measures how much influence the system has on improving the quality of school services.

3. RESULTS AND DISCUSSION

The development of an Academic Information System at State Vocational High School 1 Pundong using the four-stage waterfall model has proven effective in producing a system that meets user needs [15]. The involvement of teachers and employees from needs analysis to testing ensures that the developed features are relevant to real-world problems such as difficulties in data retrieval and manual archiving. This finding is in line

with research by Dengen and Kurnia et al. That information systems can improve the accessibility and efficiency of data management in educational environments. The results of black box testing confirmed that all system functions run well, including the login security mechanism and data manipulation functions in each menu [16].

This success indicates that the system has met functional requirements and is ready for implementation. The expert test results obtained a score of 83.75% with the lowest operational aspect (75%), highlighting the need for improved accessibility and user instructions which is in line with Zahroh's opinion that ease of use is an important factor in the quality of educational services [17]. User testing produced a higher score of 86.81%, indicating that teachers and staff felt greater practical benefits than the experts anticipated. The aspects of ease of conveying information (95%), speed of service (95%), and ease of operation (91.25%) were the highest scores, proving that the system achieved its main objectives. This supports Parasuraman's findings that service quality is determined by user perceptions of the system's responsiveness and reliability [18]. Service Quality-based functionality testing obtained a score of 86.33% with the highest Tangibles dimension (89.33%), confirming that an attractive interface design contributes significantly to user satisfaction.

The computer facility score of only 80% reflects infrastructure constraints and reinforces Visscher's statement that the success of information technology implementation depends on the readiness of the supporting infrastructure [19]. Compared to previous studies that focused on single functions such as grade management or student admissions, this study produced a more comprehensive integrated system with eight main menus. The system's limitations on local network access open up opportunities for web-based or mobile development in line with developments in modern educational technology [20]. Thus, the developed system has been proven to be able to improve the efficiency of data management and the quality of academic services at State Vocational High School 1 Pundong. Continuous development and infrastructure improvements will further optimize the system's contribution to school services.

The findings of this study reinforce the studies of Dengen (2014) and Kurnia et al. (2014) that information systems are proven to be able to improve the accessibility and efficiency of academic data management. However, unlike previous studies that focused on a single function, this system was developed comprehensively with eight main menus to address the complex needs of Vocational School as a vocational institution. Evaluation using the Service Quality aspect not only confirmed the importance of responsiveness and reliability as Parasuraman's theory, but also identified a gap in the form of low operational aspects (75%), which is in line with the findings of Alfiansyah et al. (2026) that constraints on system stability and workload. The duplication of incomplete integration is a major obstacle to efficiency [21]. Thus, this study confirms that the success of information system implementation is not solely determined by sophisticated features but also depends heavily on ease of use, infrastructure readiness, and comprehensive data integration as the foundation for improving the quality of continuing education services.

The novelty of this research lies in the approach to developing an academic information system that integrates the evaluation of its impact on service quality through active user participation from the needs analysis stage, in contrast to the research of Nukhbatillah (2026) which focused more on the contribution of developing human resource managers to service satisfaction in higher education. Likewise, in contrast to the study of Agustina et al. (2026) which only focused on the digitization of PPDB services as a single-function administrative efficiency solution, this research presents an integrated system with eight main menus that address the comprehensive needs of SMK as a complex vocational institution [22]. Thus, this research fills the gap in previous studies by proving that the development of a participatory and integrated information system can bridge the gap between increasing the capacity of human resource managers and the actual needs of users in the field.

The implications of this research indicate that the development of a user-participatory academic information system not only improves administrative efficiency but also contributes to strengthening a digital work culture and the professionalism of educational staff in vocational high schools. This finding aligns with research by Firasti et al. (2026) who demonstrated that digitalization of library management can improve recording accuracy and user satisfaction, and by Rida et al. (2026) who emphasized that an integrated information system successfully promotes transparency and systematic documentation of extracurricular activities [23]. Therefore, the developed system has the potential to serve as a foundation for the development of broader digital-based educational services, such as integration with school financial systems and digital libraries, the sustainability of which depends on infrastructure support and human resource training.

This study has several limitations that need to be considered, especially in the aspect of supporting infrastructure where the computer facility score only reached 80%, reflecting technological readiness constraints that are in line with the findings of Muallim et al. (2026) that limited facilities such as unstable internet connections can hinder the optimization of school administration services. In addition, the system developed is still based on a local network (LAN) and has not been fully integrated with other academic services such as e-Rapor, even though Azizah (2026) emphasized that the integration of an integrated academic information system with digital reporting features is a key factor in increasing the efficiency and transparency of educational services [24]. Another limitation is that this system is only intended for teachers, employees, and principals, so students and parents cannot yet access academic information independently, in contrast to the findings of Muallim et al. (2026) who

showed that active involvement of students and parents in the school administration system can improve accountability and overall service satisfaction.

3.1. Results Of Needs Analysis

Based on the results of the needs analysis conducted through interviews and questionnaires at State Vocational High School 1 Pundong, it was found that the school requires a structured information system that can accommodate all school academic data. The results of interviews with the Vice Principal of Public Relations revealed that currently the management of teacher, student, employee, schedule, and inventory data is still done manually, which requires a long time to search and archive data [25]. The questionnaire given to teachers also emphasized the need for an information system that can facilitate access to information and academic data, even though supporting facilities such as computers are still limited. Limited facilities mean that the information system developed is specifically for the principal, teachers, and employees only with eight main menus according to the school's needs. Thus, the results of this needs analysis become the basis for the development of an Academic Information System that is appropriate to the conditions and needs of State Vocational High School 1 Pundong.

3.2. Product Development Results

Based on the product development results, the Academic Information System at State Vocational High School 1 Pundong has been successfully developed through three main stages: database creation, interface creation, and coding [26]. The system database was built using Microsoft Access, consisting of nine tables, including databases for teachers, students, employees, incoming mail, outgoing mail, school inventory, class schedules, teacher schedules, and room schedules.

Table 1. Teacher Database Design Table

NO	Field Name	Data Type	Field Size
1	NIP	text	23
2	Name	text	30
3	Gender	text	10
4	Position	text	20
5	Group	text	5
6	Place of Birth	text	20
7	Date of Birth	Date/Time	Medium date
8	Address	text	70
9	Telephone/mobile number	text	14

The system interface display was developed using Borland Delphi 7 software which produces nine main pages, namely the login page, teacher data, student data, employee data, correspondence, school inventory, class schedule, teacher schedule, and room schedule.

Figure 2. Main Page View

The system was coded using the Borland Delphi 7 programming language, which connects the interface to the database so that the system can function according to the established design. All menus in the system are equipped with features for adding, modifying, deleting, and searching data, making it easier for users to manage the school's academic data. Therefore, this information system is ready for testing and implementation at State Vocational High School 1 Pundong.

3.3. Black Box Test Results

Based on the results of the Black Box testing that has been carried out, the Academic Information System at State Vocational High School 1 Pundong shows functionality that runs as expected [27]. This testing includes navigation of the Login page and the main page, where all test scenarios provide appropriate results. On the Login page, the system successfully denies access when the username and/or password are not filled in, and grants access when the username and password are filled in correctly according to the database. Furthermore, the system also successfully displays the main administrator page and each user's page properly. Thus, it can be concluded that this information system has met the functional requirements and is ready to be operated by users.Tabel 2. Pengujian Black Box.

No	Navigation	Expected results	Results	
			In accordance	No
1.	Login Page	Displaying the Login page	√	
	a. Logging in without entering a username and password	Unable to log in to the system	√	
	b. Logging in without entering a username	Unable to log in to the system	√	
	c. Logging in without entering a password	Unable to log in to the system	√	
	d. Log in by entering the username and password specified in the database.	Can enter the system	√	
2.	Home Page / Administrator	Displays the Administrator main page	√	
3.	User Page	Displays each user's page	√	

3.4. Test Results For System Work (Phase I)

Based on the results of the first phase of testing conducted by two experts, the Academic Information System at State Vocational High School 1 Pundong obtained a score of 83.75%, which is included in the "very good" category. The assessment covers four main aspects, namely design, usability, quality, and system operation [28]. The design aspect received a score of 87.5%, the usability aspect 87.5%, the quality aspect 85.42%, and the operation aspect 75%. These results indicate that the developed system has met the feasibility criteria in terms of appearance, benefits, and information quality. Thus, this information system is declared suitable for use and is proceeded to the next testing stage.

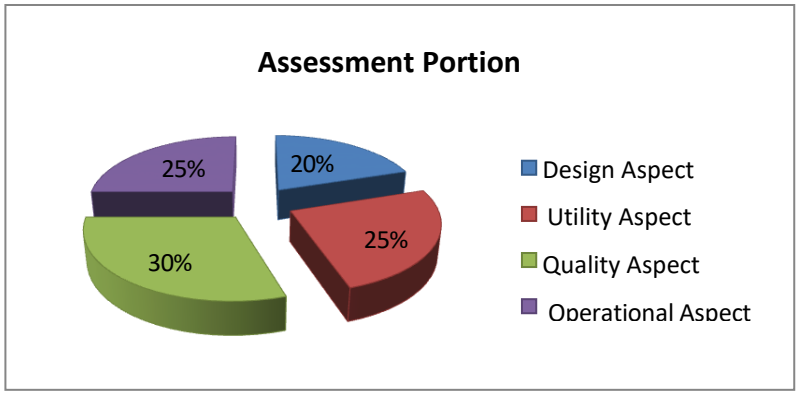

Figure 3. Trial Assessment Portion 1

3.5. Test Result For System Performance (Stage II)

Based on the results of the second phase of testing involving 20 respondents, the Academic Information System at State Vocational High School 1 Pundong obtained a score of 86.81%, which is included in the "very good" category. This score was obtained from the same four aspects as the previous test, namely design, usability, quality, and system operation [29]. These results indicate an increase in the score from the first phase of testing, which only reached 83.75%. Thus, the developed information system has proven to be very suitable for use and is able to replace the previous academic information system. This success also shows that the system has met user needs in managing academic data at the school.

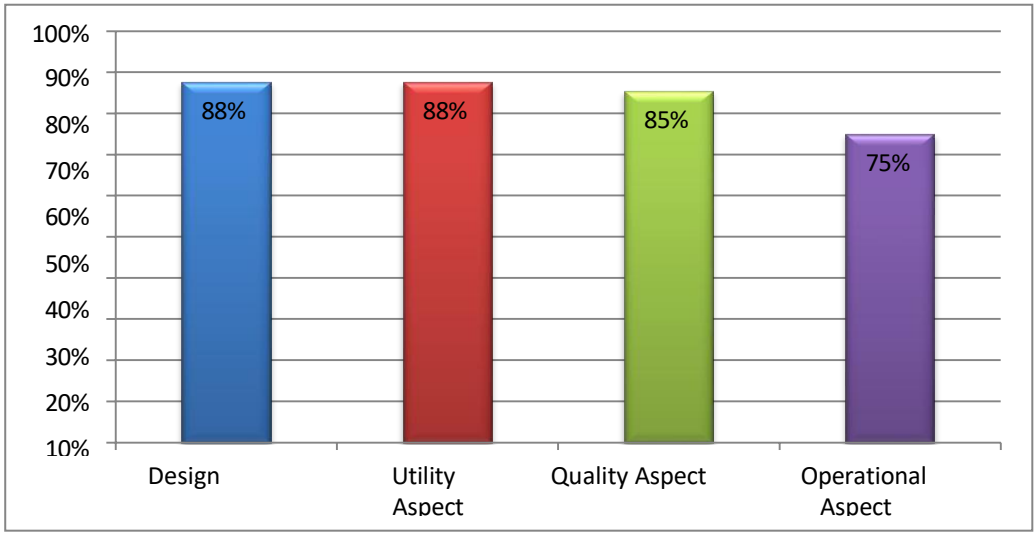

Figure 4. Percentage of Trial 1 Assessment

4. CONCLUSION

This research has successfully achieved all the objectives set out in the introduction, namely producing a desktop-based Academic Information System with eight main menus developed using Borland Delphi 7 and Microsoft Access database [30]. The needs analysis identified that the school requires a structured system to manage teacher, student, employee, inventory, correspondence, and schedule data to replace the inefficient manual system. The system performance was proven to be very good based on expert testing (83.75%) and user testing (86.81%), both of which were categorized as "very good". The implementation of the system also had a positive impact on the quality of school services with a functionality test score of 86.33% in all five dimensions of Service Quality. Future development prospects include expanding the system to be web-based or mobile, adding online PPDB and school finance modules, and improving computer infrastructure to optimize system implementation.

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