



Web-based Academic Information System at Darun Najah Islamic

Fauzan Prasetyo Eka Putra^{1✉}, Iksan², Nailus Saadah³

^{1,2,3}Faculty of Engineering, Universitas Madura

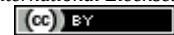
prasetyo@unira.ac.id

Abstract

The development of a web-based academic information system at Darun Najah Islamic Middle School is an important step in increasing the efficiency and effectiveness of academic data management. The Agile Scrum method is used as the main approach in this research to deal with the dynamics of changing user needs. This research describes the system development process which includes requirements analysis, design, development, testing and system implementation. The implementation results show a significant increase in flexibility, adaptability, and user involvement in the development of academic information systems. Additionally, implementing Agile Scrum also presents challenges related to adequate user involvement and accurate time and cost estimates. Implications for subsequent system development include the use of an iterative model and an emphasis on continuous delivery to ensure the system is relevant and adaptive to changing educational needs.

Keywords: Agile Scrum, Education, System Development, User Involvement.

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1. Introduction

The emergence of information technology has revolutionized various sectors, including education, by introducing innovative tools and systems that enhance the learning experience. Since the introduction of computers in classrooms in the late 20th century, technology has continued to develop and influence teaching methods and academic data management. From the use of educational software, e-learning platforms, to integrated school management systems, technology has provided various solutions to increase efficiency and effectiveness in education.

For example, the use of Learning Management Systems (LMS) such as Moodle and Google Classroom have enabled remote teaching and learning, providing wider access to educational resources. In developed countries, leading schools and universities have utilized technology to create more interactive and collaborative learning environments. A study conducted at the University of Michigan showed that the use of an LMS significantly increased student participation and learning outcomes (Smith et al., 2020).

However, despite the many benefits offered, the application of information technology in education also faces challenges. The digital divide remains a problem in many regions, where access to technology and the internet is uneven. Additionally, there are also concerns regarding data security and privacy, especially with the increasing use of cloud-based systems.

With more and more educational institutions adopting computerized systems, academic data management has become more sophisticated and efficient. Computerized academic information systems facilitate high-speed data processing, ensuring accuracy and precision in data storage, processing and analysis. The system also maintains data integrity and allows easy accessibility, which is critical for timely decision making.

A computerized academic system consists of several main components, including a database that functions as central storage for all academic data, a user interface that facilitates interaction between users and the system, and functional modules that support various academic tasks such as scheduling, grade management, and attendance tracking. Each of these components plays an important role in ensuring the system runs smoothly and meets user needs.

However, the implementation of a computerized academic system is not without challenges. One of the biggest challenges is the cost of system development and maintenance which can be a burden for educational institutions, especially those with limited budgets. Additionally, resistance to change from staff and users can also be a barrier, especially if they are used to manual methods. To overcome these challenges, a thoughtful approach to planning and implementation is required, including adequate training for users and ongoing support from management.

Darun Najah Islamic Middle School, which is dedicated to developing students' academic competence and character, faces considerable challenges in managing academic data. Current manual processes in data management are time-consuming and prone to errors. For example, recording grades is done manually by teachers using paper worksheets, which are then collected by administrative staff to be input into the system. This process is not only time consuming but also increases the risk of human error, such as typos or lost documents.

In the case of student absenteeism, teachers must record the presence of each student in class manually, and this data is then submitted to administrative staff for input. This process often causes delays in reporting absences, which can impact rapid follow-up on students who are frequently absent. In addition, communication of academic information to students and parents is often done face to face, via paper media, or via WhatsApp for daily updates. Methods like this are not only inefficient but also fail to meet the demands of the modern educational environment which demands real-time and accurate access to information.

An example of a case that shows the negative impact of this manual system is when an error occurs in recording final semester exam scores. A student who should have passed with good grades, was recorded as not having passed due to a data input error. This causes confusion and dissatisfaction from students and their parents, and requires additional time to correct the error. In addition, manual scheduling of lessons often causes schedule conflicts, where a teacher is required to teach in two different classes at the same time.

In comparison, other educational institutions that have adopted web-based academic information systems show significant improvements in the efficiency and accuracy of data management. In these schools, student grades can be input directly by teachers via a digital interface integrated with the central system, reducing the risk of errors and speeding up the reporting process. Student attendance is recorded using an electronic device that is directly connected to the database, enabling real-time attendance reporting. In addition, communication of academic information is carried out through an online portal that can be accessed by students and parents anytime and anywhere, ensuring that the information provided is always accurate and up to date.

Thus, the challenges faced by Darun Najah Islamic Middle School in managing academic data manually show the need for changes towards a more modern and efficient system. Implementing a web-based academic information system can be an effective solution to overcome this problem, increase school operational efficiency, and provide faster and more accurate information services to all stakeholders.

To overcome these challenges, the implementation of a web-based academic information system is proposed. This system will streamline various academic and administrative activities, including student data processing, information storage, learning scheduling, and performance assessment. By adopting this technology, SMP Islam Darun Najah aims to increase the efficiency and accuracy of data management, providing better and faster services to all stakeholders. The new system is expected to transform school operations, ensuring a more effective educational environment.

Before the introduction of a web-based academic information system, data management at Darun Najah Islamic Middle School was done manually. Student data, grades, and attendance records are stored in simple paper and spreadsheet formats. This process is time consuming, prone to errors, and difficult to access for parties who need information quickly. Administration and teachers often have to work overtime to manage and process data, which reduces the time they can dedicate to other educational activities.

2. Research Methods

2.1. Research Approach

This study uses a mixed methods approach, combining qualitative and quantitative methodologies to gain a comprehensive understanding of the system requirements, design, development, testing, and implementation phases. The qualitative approach includes in-depth interviews, focus groups, and observations to gather detailed insights into the needs and challenges schools face. These qualitative data sources help understand the context and needs of users from various perspectives. On the other hand, a quantitative approach involves surveys and questionnaires that aim to measure system performance, user satisfaction, and the impact of the new system on school operations. This mixed methods approach ensures a robust evaluation of system effectiveness and user acceptance.

A mixed methods approach was chosen because it allows researchers to gain in-depth insights from multiple points of view. Qualitative methods such as interviews and observations provide a detailed picture of user perceptions and experiences, while quantitative methods such as questionnaires allow more objective measurements of levels of satisfaction and efficiency. Combining these two methods ensures that research results are not only relevant and valid, but can also be measured and evaluated systematically.

2.2. System Development Methods

The Agile Scrum methodology was chosen as the main approach in developing a web-based academic information system at Darun Najah Islamic Middle School. Agile Scrum is a software development methodology that prioritizes flexibility and responsiveness to changing user needs. This approach is especially suited to projects that are dynamic and require continuous iteration, such as the development of academic information systems.

2.2.1. Basic Agile Scrum Principles

Agile Scrum consists of several basic principles that form the foundation of system development:

1. Iterative Development:
The development process is carried out iteratively through a series of sprints, each of which usually lasts two to four weeks. Each sprint produces an increment, which is a functional version of the product that can be tested and evaluated by users.
2. Incremental Delivery:
Each increment adds new functionality to the system, allowing the team to continue to develop and improve the product incrementally. These increments can always be used by end users, providing the opportunity for ongoing feedback.
3. Collaboration and Communication:
Agile Scrum emphasizes the importance of collaboration and effective communication between team members and with end users. Regular meetings such as daily stand-ups, sprint planning, sprint reviews, and sprint retrospectives facilitate ongoing communication.

2.2.2. Stages in Agile Scrum

1. Sprint Planning:
Each sprint begins with sprint planning, where the team defines the sprint goal and selects items from the Product Backlog to work on during the sprint. The Product Owner, who represents user interests, is responsible for prioritizing the backlog.
2. Daily Stand-Up:
Every day, the team holds a short meeting called the daily stand-up or daily scrum. At this meeting, each team member reports what they have done, what they will do, and the obstacles they have faced.
3. Sprint Review:
At the end of each sprint, the team holds a sprint review where they demonstrate the increments they have developed to the Product Owner and other stakeholders. This is an opportunity to get immediate feedback and make adjustments if necessary.
4. Sprint Retrospective:
After the sprint review, the team holds a sprint retrospective to evaluate their work processes and look for ways to improve the team's efficiency and effectiveness in the next sprint.

2.2.3. Tools and Techniques Used

To support the Agile Scrum process, several tools and techniques are used:

1. JIRA
JIRA is used as a project management tool to track sprint progress, manage backlogs, and visualize team workflow. Each backlog item is broken down into actionable user stories and estimated using story points.
2. Trello
Trello is used for task visualization boards, helping teams see tasks in progress, completed, and upcoming. This makes communication and collaboration between team members easier.
3. User Stories
User stories are used to describe system needs and functions from the user's perspective. Each user story contains a brief description of the desired feature, who needs it, and the reasons behind the need.
4. Story Points and Burndown Charts
Story points are used to estimate the effort required to complete each user story. Burndown charts help teams monitor sprint progress and ensure that work is completed on time.

2.2.4. Case Study

In the first sprint, the team focuses on gathering and analyzing requirements from stakeholders such as administrators, teachers, students, and principals. They use user stories to document user needs and prioritize backlogs based on importance. During sprint planning, the team decided to develop basic features such as lesson scheduling and attendance tracking. At daily stand-ups, teams report on their progress and identify obstacles such as integration with online evaluation systems. Sprint reviews are held to demonstrate features that have been

developed and get feedback from users. In the sprint retrospective, the team identifies areas of improvement, such as the need for better communication with end users to ensure that the features being developed actually meet their needs.

With the Agile Scrum approach, the development of the academic information system at Darun Najah Islamic Middle School has become more flexible, adaptive and responsive to changing user needs. This approach ensures that the system being developed not only meets initial needs but can also adapt to changing needs in the future.

2.3. Research Stages

This research was carried out through several stages as follows:

1. Need analysis

The needs analysis stage involves collecting comprehensive data from various stakeholders, including teachers, administrative staff, and students, to identify important features of an academic information system. Techniques such as interviews, observations, and questionnaires are used to gather detailed information about current challenges and desired functions. Data is analyzed to prioritize features that meet the most critical needs.

2. System planning

At the planning stage, the system architecture is designed based on requirements analysis. This includes creating Data Flow Diagrams (DFD) to visualize the flow of information in the system, Entity Relationship Diagrams (ERD) to define data structures, and user interface design to ensure ease of use. The planning stage aims to provide a clear and detailed system development blueprint.

3. System development

The development of the academic information system at Darun Najah Islamic Middle School was carried out using the Agile Scrum approach, which consists of several interrelated stages:

a. Sprint Planning

Each sprint begins with careful planning of the goals and expected deliverables. The team holds a sprint planning meeting to determine the user stories that will be implemented during the sprint based on the priorities and user needs that have been identified.

b. Implementation and Coding

Development was carried out using PHP, MySQL, and XAMPP technology for the backend and user interface. Each system feature or module is implemented in stages in sprint iterations, starting from basic setup to integration with existing systems.

c. Testing and Validation

Once coding is complete, each system component undergoes a series of tests. Unit testing is used to ensure the function of each component works well individually. Integration testing is carried out to verify that all components work together without problems. UAT involves end users to validate the system in a real production environment.

4. Implementation of Testing Techniques

a. Unit Testing

Each system component, including user management, lesson scheduling, and grade reporting, is tested separately to ensure their function meets established specifications.

Integration Testing:

The coded components are integrated together to ensure harmonious interaction between each part of the system.

b. User Acceptance Testing (UAT)

Teachers, administrative staff, and students are invited to use the system in a trial environment and provide feedback on their user experience. The results of UAT are used to make final adjustments before implementing the system as a whole.

5. System Implementation

Once testing is complete and the system is approved by users, the implementation phase begins. This includes installing software, migrating data from the old system, training users on the new system, and preparing detailed documentation. The implementation phase ensures a smooth transition to the new system, minimizing disruption to school operations.

6. Evaluation and Maintenance

Post implementation, system performance continues to be monitored and evaluated through user satisfaction surveys and performance analysis. Routine maintenance and updates are carried out based on evaluation results to overcome problems and ensure the system remains efficient and effective in meeting user needs.

2.4. Research Instruments

The instruments used in this research include:

a. Interview Instrument

Interviews are one of the main instruments used to collect qualitative data from various stakeholders at Darun Najah Islamic Middle School. The approach used includes semi-structured interviews with topic guides that have been prepared in advance. Interview procedures include:

1. Identification and selection of respondents based on their role and experience in using academic information systems.
2. Use of open questions to explore users' views and experiences of the existing system as well as their expectations of the new system.
3. Recording and analysis of interview transcripts to identify emerging patterns and themes related to system requirements.
4. The results of these interviews are used to inform the system requirements analysis stage, prioritize features that must be developed, and ensure that the resulting solution meets user expectations.

b. Questionnaire

Questionnaires are used as a tool to measure user satisfaction with the newly developed academic information system. The questionnaire design was carried out by considering the following aspects:

1. Development of a list of questions covering key dimensions such as system usability, performance, reliability, responsiveness and ease of use.
2. Validate the questionnaire through limited testing to ensure the clarity and relevance of each question.
3. Electronic distribution of questionnaires to selected respondents, including teachers, administrative staff, and students, with clear instructions to ensure optimal response rates.
4. Data obtained from this questionnaire is then analyzed using descriptive statistical methods to measure the level of user satisfaction and perception of the newly developed system.

c. Observation

Observations were carried out in the school environment to understand existing operational processes and the challenges faced in managing academic data manually. The aspects observed include:

1. Interaction between teachers, administrative staff, and students in collecting, processing, and reporting academic data.
2. Use of existing information technology and a tendency to use web-based applications for daily administration purposes.
3. Identify processes that are prone to errors or delays in producing accurate and timely academic information.

The results of these observations provide a direct view of how existing systems work and provide the insight needed to design new academic information systems that are more efficient and effective.

2.5. Data Sources

Data sources in this research consist of:

1. Primary Data: Data obtained directly from interviews, questionnaires and observations with related parties at Darun Najah Islamic Middle School.
2. Secondary Data: Data obtained from school documentation, literature, and previous research that is relevant to the research topic.

2.6. Data Analysis Techniques

a. Descriptive Data Analysis

Descriptive data analysis is used to provide a comprehensive picture of the characteristics of the newly developed academic information system. The analytical methods used include:

- a. Descriptive Statistics: Presents statistics such as the mean, median, and range of the variables being measured, such as system response time or user satisfaction level.
- b. Frequency Distribution: Shows data distribution in tabular or graphical form to understand system usage patterns based on user role or access time.

Examples of the results of this descriptive analysis reflect the level of efficiency and responsiveness of the new system to school operational needs, by showing significant improvements in data processing and access.

b. Statistical Analysis for Measuring System Performance

System performance measurements are carried out using statistical methods to compare system performance results before and after implementation. This analysis method includes:

1. Use of Performance Metrics: Includes metrics such as throughput (amount of data processed per unit of time), response time, and transaction failure rate.

2. Statistical Tests: Use of t-tests or analysis of variance (ANOVA) to validate significant performance improvements following implementation of a new system.

The results of this statistical analysis show that the new academic information system is not only more efficient in data management but is also able to increase productivity and overall user satisfaction.

c. Evaluation of the Success of Sustainable Implementation

1. Continuous evaluation is carried out to monitor and evaluate system performance periodically. The evaluation process includes:
2. User Satisfaction Survey: Conducted periodically to collect feedback from users about their experience with the system.
3. Performance Analysis: Involves monitoring key performance indicators such as system utilization rates, response times, and error rates.

This evaluation not only ensures that the system remains relevant to evolving user needs but also identifies areas that require improvement or further development in the maintenance phase.

3. Results and Discussion

a. Implementation System

The development and implementation of the web-based academic information system at Darun Najah Islamic Middle School followed the Agile Scrum methodology. The development process was divided into iterative sprints, each lasting two weeks. Key stages included:

Sprint 1: Focused on gathering and analyzing requirements from stakeholders such as administrators, teachers, students, and principals. User Stories were created to represent functional requirements and were prioritized based on importance.

Sprint 2: Initial development included setting up the basic system architecture, including database structure, user interface, and user management features. Basic functionalities like lesson scheduling and attendance tracking were implemented.

Sprint 3: Further development added features such as grade management, assignment tracking, and integration with online evaluation systems. User feedback was continuously incorporated to refine these features.

Sprint 4: Focused on system integration testing to ensure all components worked together seamlessly. User Acceptance Testing (UAT) involved end users to validate the system and gather feedback for final adjustments.

b. Successful Implementation

The implementation of a web-based academic information system at Darun Najah Islamic Middle School using Agile Scrum has achieved several main successes:

1. Flexibility and Adaptability: The Agile Scrum methodology allows the development team to adjust priorities and features based on feedback received from users at each Sprint iteration. This ensures that the system being developed not only meets initial needs but can also adapt to changing needs in the future.
2. User Involvement: Through Daily Stand-up and Sprint Review practices, users (administrators, teachers, students, and principals) are actively involved in the development process. This ensures that the system developed not only meets user expectations but is also relevant to the school's operational context.
3. Continuous Delivery: By adopting a Sprint-based development cycle, teams can periodically produce improvements to the system that can be tested and evaluated by users. This makes it possible to implement the system in stages and minimizes large-scale implementation risks.

3.2. Discussion

The application of Agile Scrum in the development of academic information systems at Darun Najah Islamic Middle School shows a number of advantages and challenges that are relevant to this methodology.

a. Profit

Responsive to Change: The Agile Scrum methodology allows teams to respond quickly to changing needs. This is especially important in educational environments where needs and priorities often change over time.

1. High User Involvement: Sprint Review and Daily Stand-up processes regularly involve end users in development. This not only increases system adoption but also ensures that the solution developed truly meets their needs.
2. Incremental Delivery: By producing functional increments every two weeks, the team can progressively refine and improve the system. This reduces the risk of massive errors and allows for continuous evaluation of the quality of the solution being developed.

b. Challenge

1. Adequate Involvement of Users: Although Agile Scrum emphasizes user involvement, challenges may arise if there is a delay in feedback or if user representation is not diverse enough to accommodate the needs of all potential users.
2. Difficulty in Time and Cost Estimates: Agile Scrum is often difficult to predict in terms of time and cost estimates due to its adaptive and flexible nature. This can create challenges in project management that require more rigid estimates.

3.3. Implications for Subsequent System Development

The application of Agile Scrum in the development of academic information systems at Darun Najah Islamic Middle School has significant implications for subsequent system development:

1. Use of Iterative Models: Iterative models such as Agile Scrum can be an effective approach for developing systems that require adaptation to rapidly changing requirements and technology.
2. Importance of User Involvement: Active involvement of users throughout the entire development cycle is key to system success. This ensures that the resulting solution not only functions well but is also relevant to user needs.
3. Emphasis on Continuous Delivery: By adopting a continuous development cycle, organizations can accelerate the delivery of solutions that are valuable to users and minimize the risk of implementation failure.

4. Conclusion

The implementation of a web-based academic information system at Darun Najah Islamic Middle School using the Agile Scrum methodology succeeded in providing a solution that was responsive and adaptive to user needs. By facilitating active involvement from stakeholders, including administrators, teachers, students and school principals, this system is able to overcome the challenges of managing academic data which was previously done manually. The successful implementation of this system is reflected in increased operational efficiency and the provision of faster and more accurate information services to all stakeholders. However, the challenges faced, such as adequate user involvement and accurate cost planning, indicate the need for a more mature approach to information technology project management in educational environments. Thus, the development of a web-based academic information system using the Agile Scrum methodology can be used as a reference for improving the quality of educational services in the future.

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