

Web-Based Digitalization of Evaluation Sheets for The Competency Practice Course of The Air Traffic Management Study Program at The Makassar Aviation Polytechnic

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| ARTICLE INFO | ABSTRACT |
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| <p>Article history Received April 18, 2025 Revised May 15, 2025 Accepted June 29, 2025</p> | <p>This article aims to determine the conditions for implementing manual daily evaluation sheets in the ATM Study Program and to develop the digitalization of website-based evaluation sheets. The research method used is the Rapid Application Development (RAD) research method. This method aims to shorten the time needed to plan, design, and implement a system. The respondents were 12 lecturers and 2 educational staff members from the ATM study program. The testing technique uses the Black Box Testing method aimed at students, lecturers, and educational staff to test each menu on the website. Test results show that each menu works as expected. So it can be concluded that the digital evaluation sheet is successful because lecturers can easily input the grades for practicum activities, and education staff can easily monitor practicum results and summarize student assessment data. "Black-box testing shows 100 percent successful execution of key website features across all user types, indicating substantial gains in monitoring efficiency. Educational staff reported reduced reporting time by over 50 percent compared to manual systems, demonstrating the system's practical impact."</p> |
| <p>Keywords Daily Evaluatio Sheet, Website Rapid Application Development (RAD)</p> | |

I. Introduction

Air transportation refers to the use of any aircraft or aviation technology designed to move and/or transport passengers and cargo through controlled airspace. This mode of transportation plays a critical role in supporting national and international mobility, economic development, and disaster response [1], [2]. Within this domain, there exist specialized professionals known as flight personnel, who are essential to the operation, safety, and management of aviation systems. According to Law Number 1 of 2009 on Aviation, flight personnel are individuals who hold official licenses or certifications and are entrusted with specific duties and responsibilities within the aviation sector [3]. These competencies are not innate but are developed through structured educational pathways and rigorous training programs, provided by accredited aviation institutions. One such institution is the Makassar Aviation Polytechnic, which serves as a strategic center for cultivating technically proficient and safety-oriented aviation professionals [4], ensuring adherence to both national regulations and international standards in civil aviation.

Makassar Aviation Polytechnic is a specialized vocational institution operating under the authority of the Indonesian Ministry of Transportation, reporting directly to the Head of the Transportation Human Resources Development Agency. As part of its mandate to educate and prepare highly qualified aviation professionals, the polytechnic offers four Diploma III-level (three-year) study programs. These include Air Traffic Management, which emphasizes the safe and efficient handling of airspace [5]. Airport Technology, focusing on airport

infrastructure and operations [6]. Air Navigation Technology, dedicated to the systems and procedures that support aircraft navigation [7], and Aircraft Maintenance Technology equips students with the technical expertise required to ensure aircraft airworthiness and safety [8]. Each program is designed to respond to the evolving demands of the aviation sector and to align with international standards for civil aviation training [9].

Unlike the other 3 (Three) Study Programs that focus on aspects of aviation engineering and technology, the Air Traffic Management Study Program (ATM Study Program) focuses more on aspects of aviation safety. It is opened to educate and train aviation personnel, especially in the field of air traffic control, or known as Air Traffic Controller (ATC). ATC is aviation personnel whose job is to guide aircraft by communicating directly with pilots. According to Susanto [3], ATC works through a communication network and special equipment that can detect aircraft movements and weather information to guide pilots on duty. ATC has an important role in creating aviation safety, so prospective ATC personnel need sufficient knowledge, physical, and mental provisions during their education and training. According to Hamid [10], prospective ATCs need to be trained as well as possible physically and mentally because, in addition to external factors such as weather and the environment, there are internal factors within ATCs that can also cause aircraft accidents.

Furthermore, related to its responsibility to educate and train prospective ATCs, the ATM Study Program has a set of learning materials related to air traffic control practices.

The learning materials are in a curriculum involving highly competent academics and practitioners. According to Wardina [11], the curriculum, especially in vocational education, is always required to adapt to changing conditions, technological changes, and the needs of the world of work. Therefore, the involvement of all parties in preparing the ATM Study Program curriculum is expected to produce a comprehensive curriculum relevant to the world of work so that it can produce prospective ATC personnel who are competent and adaptive in dealing with situations in the field.

In general, the task of an ATC is to provide air traffic services to every aircraft under their guidance while still paying attention to safety and security factors in flight. Therefore, prospective ATCs in the ATM Study Program will be taught about Aerodrome Flight Information Services (AFIS), Aerodrome Control Tower (ADC), Approach Control Procedure (APP), and Area Control Center (ACC) as the main material that prospective ATCs must master. The four main courses are presented not only in theory but also in laboratory practice. In line with this, according to Muhajarah [12], learning through laboratory practice, both virtually and directly, has a positive impact on students' readiness to face real situations in the world of work. Therefore, considering the importance of achieving competency in the four courses, the ATM Study Program monitors the development of its students through a Daily evaluation sheet.

According to Tamin [13], monitoring is an ongoing activity that is used to monitor students' development. Monitoring can be done manually or digitally, according to the needs and abilities. As a monitoring tool, the daily evaluation sheet functions as a form of monitoring students when doing practicums. However, at any time, the Daily evaluation sheet in the form of a book with manual development recording is likely to be lost or dirty because it is always carried daily. Another disadvantage of this manual Daily evaluation sheet is the difficulty of monitoring every time from the study program because the Daily evaluation sheet in the form of a hard copy is collected by students at the end of the semester or the end of the education and training program period. This is clearly not by the principle of monitoring. According to Susanti [14], monitoring activities must be carried out continuously and in real time to present actual and accurate data. This condition certainly needs to be addressed immediately and adequately, considering the importance of this monitoring process to see the achievement of student competencies as prospective ATCs.

The manual Daily evaluation sheet means that monitoring cannot be carried out every time, even though the monitoring results need to be carried out every time, so that they can be used as material for decision making as quickly as possible, to minimize the emergence of bigger problems. A study by Jadhav et al. (2021) [15] in the context of vocational education shows that digitalization

of the evaluation process not only speeds up feedback but also increases the accuracy of data recapitulation, which is useful in institutional decision making. A facility is needed that can be used to develop each student's competency achievements and can be accessed by interested parties. The digitization of the Daily Evaluation Sheet can be an alternative solution to overcome these problems. According to Sutinah [16], the Digitization of learning monitoring systems can present more actual and accurate data than monitoring activities manually. Digitization of Daily Evaluation Sheets allows for real-time input of development data, which interested parties can easily access and monitor. Websites are the most appropriate, fast, and accurate information media because all the information described on the website page can be conveyed clearly and supports each other. Therefore, website-based digitization can provide convenience in inputting, monitoring, and reporting, so it is hoped that there will be an increase in the quality of educational institutions, especially in terms of the achievement of learning competencies by each of its graduates.

A. Hypothesis

Each student currently holds the daily evaluation sheet manual. The book will be collected for the ATM Study Program when the final practical exam is carried out, so the monitoring process cannot be carried out while the practical activity is still running. Learning progress should be monitored in real time to monitor the development or progress of student learning. In addition, educational staff who are tasked with summarizing grades as material for learning outcome reports need quite a long time in the process of collecting books and the process of inputting recapitulation grades. Digitization will shorten the time needed for reporting learning outcomes. Based on this, the hypothesis is that digitizing website-based evaluation sheets will make input, monitor, and report grades in the ATM Study Program easier.

II. Method

The research design uses the Rapid Application Development (RAD) research method. According to Rosa and Salahuddin [17], Rapid Application Development (RAD) is an incremental software development process model that is especially useful for short processing times (approximately 60 to 90 days). Compared to traditional methods, this method aims to shorten the time needed to plan, design, and implement a system. This article uses the Rapid Application Development (RAD) research method. According to Rosa & Salahuddin [17], Rapid Application Development (RAD) is an incremental software development process model that is especially useful for short processing times (approximately 60 to 90 days). Compared to traditional methods, this method aims to shorten the time needed to plan, design, and implement a system. The research design with the Rapid Application

Development (RAD) method has a cycle that is described as follows:

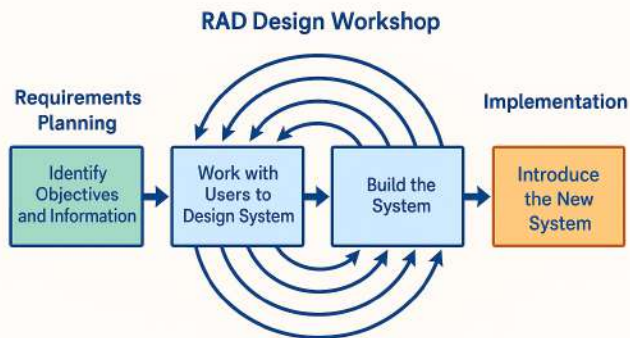


Fig. 1. Research Design

The image shown shows the Rapid Application Development (RAD) cycle with 3 (three) phases in planning, designing, and implementing the system involving analysts and users, which are further described as follows:

A. Planning Stage

At this stage, users and analysts will meet to identify the system's objectives and the information requirements that arise from these objectives. The main orientation at this stage is to find alternative solutions to solve user problems.

B. Design Stage

Analysts and users will work together to design and build the system. Depending on the application size to be developed, this stage can last several days. At this stage, users will respond to the existing prototype, and analysts will improve the design based on their input and responses. This work pattern will drive development to the final level. To further aid understanding, a process flow diagram was created to visualize the interactions between users (students, lecturers, administrators) and the key system functionalities across input, monitoring, and reporting stages.

C. Implementation Stage

At this stage, analysts who have worked intensively during the planning and design stages will then be approved by users, and the new system will be tested and introduced to the organization.

Furthermore, the research focuses on lecturers as the party that will provide input for the assessment. Therefore, the research population comprises Lecturers and Education Personnel in the ATM Study Program. A sample selection is then made from the available population, which will later participate directly in the research. The samples obtained consist of 5 external lecturers, 5 internal lecturers, and 2 education personnel in the ATM Study Program. Participants were selected using purposive sampling, targeting individuals with active roles in practicum instruction or academic reporting within the

ATM Study Program. This ensures relevant insights from stakeholders directly affected by the system.

The testing technique used in this study is black-box testing or functional testing. According to Anardani and Putera [18], testing with this method is oriented toward finding errors in incorrect system functions, interface errors, and so on. Functional testing is carried out to determine the suitability of the execution results of each feature process in the program that has been developed to meet user needs. The testing stage is carried out by directly testing the application designed on one of the devices to analyze the shortcomings and advantages of the application being developed. In the data analysis process, the validation technique is obtained from the test results by the validator, namely lecturers/instructors and education staff at the ATM Study Program.

III. Results and Discussion

The activity begins with the planning stage, which contains activities to collect data and information on the digitalization of evaluation sheets. The respondents selected are lecturers from practitioners and internal campuses who teach in the competency field practicum in the ATM study program. The respondents are from education personnel who are useful in preparing, implementing, and reporting learning outcomes. Data collection is carried out by providing questionnaires or by direct interviews. The questionnaire was semi-structured and pre-validated by two instructional design experts to ensure relevance and clarity. Interview protocols followed a guided format emphasizing practical challenges and expectations in evaluation management. In the first study, the questionnaire results were obtained from the targeted respondents, namely 5 external lecturers and 5 internal lecturers from the ATM Study Program. Questions related to how to record grades using the current daily evaluation sheet and the value input mechanism that will be created for digitizing the daily evaluation sheet.

The results of the initial data collection activities that focused on the aspect of inputting grades showed that filling out the daily evaluation sheet had the biggest obstacle, namely the lecturer's writing in the comments column that students could not understand, and the condition of the evaluation sheet book, which was dirty or damaged. This is in line with the research results of [19], [20], where digitalization in the world of education is very important to be implemented to make storage and security of documents more efficient and secure from various circumstances. Furthermore, the digitalization development plan generally received a positive response from lecturers to facilitate assessment. Regarding changes in input values, the majority of lecturers did not agree. Quantitative results showed that lecturers could input and update practical scores in under 3 minutes per student, down from an average of 10 minutes with the manual format, resulting in significant time savings over a full

semester. Still, there was input from respondents to calculate the values that had been input before being approved by their lecturers.

Figure 2 illustrates the layout of the digital evaluation sheet interface developed as part of the system implementation. Lecturers use this form to input practicum assessment data, which includes structured fields for competency criteria, scoring, and comments. The interface is designed to be intuitive and accessible across devices, supporting consistency and accuracy in student evaluations.


| AVIATION POLYTECHNIC OF AKASSAR | | DAILY EVALUATION SHEET | | NAME: Aisyah Rafraza Hamzah | |
|---|--|------------------------------|-----------|-----------------------------|--|
|  | | ADC | | NIT: C2019111338 | |
| | | | | POSITION: | |
| | | | | PROBLEM NO: | |
| | | | | DAY/DATE: | |
| NO | Evaluation Factors/ Expected performa | Score | WEAKNESS: | | |
| 1 | SEPARATION A. Separation is maintained / B. Selection of separa- C. Application of sepation D. Degree of precision(includ- ing calculation E. Traffic information | 25 | | | |
| 2 | CONTROL TECHNIQU / JUDGEMENT A. Analysis and problem sol- B. Planning abilities C. Priorities / sequence D. Effective flow / efficiency E. Visual scanning F. Aircraft identhis maintained G. Familiarisation with pattern / confliction points | 20 | | | |
| 4 | COMMUNICATION / CLEARANCE / INSTRUCTION / INFORMATION A. Use of standard phraseology B. Phoneticalphabe: /voice qu- ality to change D. Clarity of expressions E. Timcliness of issuane | 10 | 10 | | |
| 4 | FLIGHT DATA A. Completeness/correctnes B. Neatness and legibility FPS | 10 | | | |

Fig. 2. Form Digital Evaluation Sheet

The next data collection activity focused on the monitoring process aspect. The questionnaire was prepared to see the current monitoring and evaluation conditions of practical activities and the transparency of learning outcomes to students, parents, and the management of Makassar Aviation Polytechnic. Based on the data collection results, it is known that the current monitoring process must wait until the last learning process at the end of the semester, so that related parties cannot monitor the development of student learning outcomes. Many students have not achieved the expected competencies, but this is only known at the end of the semester, when learning has been completed. The development of monitoring with digitalization of evaluation sheets received a positive response from

education personnel to facilitate supervision and evaluation. This is in line with the research results of Tantri [21], which states that digitalization in educational institutions will bring many benefits, one is making it easier to monitor and evaluate student development with an actual and accurate database.

The next activity is data collection, which is carried out to determine the aspects of value reporting. The questionnaire was distributed to education personnel focusing on the reporting mechanism for the ongoing practicum activity values and the condition of the reporting records that will be carried out in the evaluation sheet digitization process. Based on the results of data collection, it is known that the value recapitulation process must wait until all the evaluation sheet books are collected, resulting in delays in the recapitulation. The development of the value reporting process by digitizing the evaluation sheet received a positive response from education personnel to facilitate the recapitulation. This is in line with the results of research conducted by Salem and Samad [22], which stated that a digital assessment system will accelerate the process of recapitulating and presenting student achievement value data compared to a manual system that uses printed assessment forms.

Respondents agreed that evaluation sheets with given values could be printed to meet archiving needs and accreditation completeness. The next is the implementation of activities that involve the development of a website-based daily evaluation sheet digitalization. This is because it is more flexible and the built system can be accessed by many platforms, making it easier for users to access. In line with this, Megawaty's Research Results [23] stated that a website-based learning monitoring system will make it easier for educators to report on the activities and developments of students, and the actual data can then be used as a reference in implementing learning evaluations. The website is built for three types of users, namely students, lecturers, and education personnel. In the student user type which is used for students, several menus are developed based on the results of activities at the planning stage, namely: teaching materials, lecture classes, lecturers, and assessment forms for each practical activity that can be used as a guide for students to find out the aspects that are the main focus of the assessment.

Furthermore, in the lecturer user type, website development is made with a simpler menu to make it easier for lecturers from different backgrounds to use the built system. Lecturer-type users can input grades and edit grades if necessary. The lecturers' assessments are then stored in the system and can be accessed by both students and other users. Finally, the education personnel user type, in this case, acts as a website admin. This type of user has many menus starting from class preparation, class participants, assessment monitoring, and reporting of learning outcome assessments.

Following the implementation of the digitized, website-based evaluation system, functional validation was conducted through black-box testing involving all user types. While the overall feedback was positive, a few implementation challenges were identified. Notably, some lecturers unfamiliar with digital platforms required brief orientation sessions to navigate the system confidently. Additionally, stable internet connectivity remains crucial, especially during off-campus practicum sessions to support real-time data synchronization.

Despite these challenges, the black-box testing process, structured around three user categories (students, lecturers, and educational staff), confirmed that the digitized evaluation sheet met the system’s functional requirements. Each user group was able to interact with the application without technical errors or navigation issues.

Table 1 presents the results of black-box testing for student users, focusing on the functionality of grade access and navigation across key features:

Table 1. Student Black Box Table

| No. | Test Scenario | Test Case | Expected results | Test Results |
|-----|--|---------------------------|---|--------------|
| 1. | Enter the link that has been created to access the evaluation sheet website | Action : Click link | The system will display the home page on the website | As Expected |
| 2. | Select the division to be viewed | Action: Click division | The system will display a list of classes. | As Expected |
| 3. | Search for a list of student names | Action : Click class list | The system will display a list of student names. | As Expected |
| 4. | After getting the name of the student you are looking for, there is an option to view the grades | Action : Click view value | The system will display an evaluation sheet of the student's practical results. | As Expected |

The results of the black-box testing in Table 1 for student users confirmed that each function operated as expected. Students were able to navigate the website smoothly without encountering system errors, particularly when entering names and accessing their practical assessment records. This confirms the system’s effectiveness in supporting real-time student self-monitoring. Table 2 outlines the results of black-box testing conducted for lecturers, who act as evaluators within the system. The table summarizes key functional scenarios, expected outcomes, and actual results during the testing phase. Each scenario was designed to validate the lecturer's ability to access and input practical scores efficiently and accurately.

Table 2. Black box table of lecturers

| No. | Test Scenario | Test Case | Expected results | Test Results |
|-----|--|---|---|--------------|
| 1. | Login | Action : Enter username and password correctly | Successfully logged into the website | As Expected |
| 2. | Search for the class and name of the student who will be given a practical grade | Action : Search for class and student name | Successfully logged in to the page | As Expected |
| 3. | Selecting the value input option | Action : Click input value to enter the assessment form | Successfully entered and inputted student practical work scores | As Expected |

Table 3 presents the black-box testing results for educational personnel who serve as administrators of the digital evaluation platform. Their primary responsibilities include managing class setup, participant registration, monitoring practicum outcomes, and generating academic reports. The testing confirmed that each critical function, such as login authentication, editing class and student data, and managing reporting menus, operated as expected. No technical issues were encountered, and administrative workflows aligned well with the system's interface design. These results demonstrate that the platform supports robust and error-free administrative operations, allowing for efficient supervision, data consolidation, and documentation processes at the program level.

Table 3. Black box table of educational personnel

| No. | Test Scenario | Test Case | Expected results | Test Results |
|-----|---------------------------------------|--|--------------------------------------|--------------|
| 1. | Login | Action : Enter username and password correctly | Successfully logged into the website | As Expected |
| 2. | Enter the student name and class name | Action : Click the class menu and student menu | Successfully registered | As Expected |
| 3. | Editing menus on a website | Action : Click on the menu you want to select | Successful editing | As Expected |

Table 4 summarizes the feedback obtained during expert validation of the digital evaluation sheet interface.

Three subject matter experts were asked to assess the system's design, usability, and content accuracy. The Validators provided targeted recommendations to enhance clarity and instructional value. For instance, they suggested standardizing terminology, such as changing "instructor name" and "assessment date" for consistency and adding specific features like a summary of assessments and indicator-based feedback. These inputs are essential in strengthening the pedagogical alignment of the system, particularly in guiding lecturers during practicum evaluations.

The validation outcomes indicate that while the system was functionally sound, minor textual and structural refinements further improved its instructional usability. Incorporating expert feedback not only reinforces system credibility but also ensures that the platform aligns with academic and professional expectations within the Air Traffic Management domain.

Table 4. Expert Validation Results Table

| No. | Coding | Validator | Note |
|-----|--------|-----------------------|---|
| 1. | WW | Subject Matter Expert | The writing of the name of the instructor is changed to instructor name The writing of the assessment date is changed to date |
| 2. | GN | Subject Matter Expert | Added a summary of the assessment. For weaknesses, per-indicator is added to make it easier for lecturers/instructors to write the practicum assessment points.. |
| 3. | AM | Subject Matter Expert | Added notes as overall notes. Improved score values. |

IV. Conclusion

This study developed and evaluated a web-based digital evaluation sheet tailored for practical competency courses in the Air Traffic Management (ATM) Study Program at Makassar Aviation Polytechnic. The system was designed to enhance efficiency, transparency, and real-time monitoring of student practicum performance. Results from black-box testing across all user roles—students, lecturers, and educational staff—demonstrated that each functional component of the system operated as intended. Notably, the system improved the accuracy and accessibility of student assessment data and reduced the time required for grading and reporting. Validation by subject-matter experts also confirmed its usability and relevance, requiring only minor refinements in label clarity and score presentation. The integration of Rapid Application Development (RAD) methodology enabled the rapid prototyping and iterative refinement of a functional platform responsive to user feedback. This research contributes to the growing discourse on educational digitalization in vocational training by

offering a domain-specific model that is both practical and scalable. Nevertheless, limitations such as the small sample size and single-institution testing context suggest the need for broader implementation studies. Future work should explore system integration with institutional learning management systems (LMS) and assess long-term impacts on instructional quality, student engagement, and institutional reporting efficiency.

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