ORIGINAL RESEARCH

UPGRADING THE WEB-BASED CREDIT SCORE CALCULATION SYSTEM

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Abstract

The development of credit score system is a development that aims to streamline the time and performance of Widyaiswara at the Makassar Religious Education and Training Center. However, the previous system development did not have the Overload task verification and credit score features, so Widyaiswara needed manual input. The Abundant Task feature is a feature that allows Widyaiswara to input credit numbers above the position following the provisions for reducing credit scores following applicable regulations. Meanwhile, the credit score verification feature ensures that the credit score entered follows the specified conditions. This study aims to develop these two features for upgrading the system using the Waterfall model development. This model was chosen because it fits the systematic and sequential system development needs. The test results show that the system has met the ISO/IEC 25010 standard; the functional feasibility is worth 1 (one), which means the system is working well. While the results of the usability test of the system are 90.4%, the system is declared very feasible to input and calculate credit scores efficiently. The result shows that the upgrading of the web-based credit score calculation system has been effectively used for inputting overflow assignments and verifying credit scores.

KEYWORDS:

Functional Suitability, Information Systems, Credit Score Calculation, Software Quality, Usability

1 | INTRODUCTION

The development of science and technology runs very fast. These developments bring people to new ways of working in completing daily activities, one of them is by utilizing internet technology. With this technology, various innovations began to be created to facilitate the acquisition of adequate and accurate information in a short time. In addition, technology has also been widely used in the professional world by building systems that can facilitate human work.

Makassar Religious Education and Training Center is an educational and training institution that has begun to implement various technological systems to facilitate the work process of employees. The system developed is a credit score calculation system for Widyaiswara. Widyaiswara is a Functional Positions which are civil servants (PNS) who had appointed to a functional position with the duties, responsibilities, authorities, and rights to carry out the process of educating, teaching, training civil servants, as well as evaluating and development of government education and training.

In general, the word system comes from the Greek origin of the word sustcma, which means the unity of several components or elements interconnected with a function to facilitate the flow of data or information, material, or energy to achieve a set goal[1]. The system is a component consisting of two or more forming a relationship to produce predetermined goals together[2]. The credit score calculation system is a system that calculates the results of obtaining credits that employees at certain agencies have carried out as a condition for promotion. This system aims to simplify and streamline working time because credit will be calculated automatically when data is successfully entered into the system. The credit calculation system successfully developed at the Makassar Religious Education and Training Center provides features for making and submitting letters and Dupak, as well as calculating the credit value in Dupak based on observations made on February 15, 2022. Dupak is a list of proposed credit figures containing details of activities, sub-activities elements, activity items, and credit numbers that Widyaiswara has carried out for the application for promotion. Widyaiswara carries out his duties based on the applicable agency work guidelines.

The current work guideline is PANRB Ministerial Regulation 42 of 2021, resulting from changes to the previous guideline, namely PANRB Ministerial Regulation 22 of 2014 concerning Widyaiswara Functional Positions. The impact of the change in the guidelines allows the system to be redeveloped following the latest guidelines. For this reason, observations and interviews were carried out with one of the Widyaiswara at the Makassar Religious Education and Training Center on March 7, 2022. From the interview results, information was obtained that the credit score calculation system for the Widyaiswara functional position requires additional features, namely the addition of the Limpah task feature and credit score verification. The Limpah task is a credit point input feature as a result of the implementation of PP 42 of 2021 article 4 articles 10 and 11, where this feature is a feature that can be accessed by all available positions with the requirement to reduce the credit score if accessing a position higher than the data input position. This feature is needed because the calculation system for the Limpah task feature is different from the system provided, so if it is not added, Widyaswara will have difficulty in the input and calculation process because he has to do it manually outside the system. Adding a credit score verification feature is necessary to determine whether the input and calculation results have followed the standards used.

Based on these problems, the resulting solution is to develop the system's features to improve the credit score calculation system. The research title to be carried out is "Upgrading the Web-based Credit Score Calculation System." The system to be developed will have the functions of inputting letters, Dupak, and calculating credit scores with additional features, namely the Limpah task feature and credit score lever.

2 | PREVIOUS RESEARCHES

Several studies are related to developing a credit score calculation system. Aththaariq[3] researched the Application for Monitoring Lecturer Academic Functional Positions to make the application able to monitor the functional positions of Lecturers, assisting the task of lecturers in filling out all tri dharma activities and calculating the total number of Lecturer credit providers. The research development method used is the waterfall method. Applications developed using the PHP programming language, CodeIgniter framework, and MySQL database. Application testing using BlackBox testing with good results.

The following research reference is from Kusdiawan[4] with the research title "Development of an Information System for Determining Teacher Credit Scores (Case Study: Malang City Education Office)." The purpose of this research is to create an information system in the form of a website platform, to facilitate checking the completeness and validity of the inputted data. The system design starts from the process of submitting a credit score, then makes a PAK document and recapitulates the PAK proposal. This research was built using the waterfall method. Testing is carried out using validation, compatibility, and usability testing. The results obtained from this test are that the teacher credit score information system has been running well.

The following research is about the "Web-Based Lecturer Credit Score Assessment Information System (Case Study of PAK Online Kopertais Region I DKI Jakarta)." Research conducted by Chotib[5] aims to overcome the problem of arranging files for
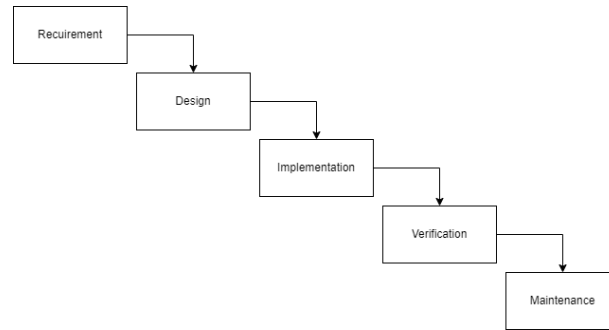
FIGURE 1 The Waterfall software development methodology.

submitting lecturer promotions, making recaps, and knowing the number of lecturers or those who will apply for academic promotions. This study used the waterfall research method and was developed using the PHP programming language, PostgreSQL database, and the Laravel framework. System testing using BlackBox testing.

3 | MATERIAL AND METHOD

The research method for developing the assignment feature and credit score verification (AK) for upgrading the web-based Widyaiswara functional position credit score calculation system (Case Study of Makassar Religious Education and Training Center) is the Waterfall model. The waterfall model has a sequential life flow approach starting from the analysis, design, coding, testing, and support or maintenance stages[6]. This process will move from one stage to another when the previous stage has been completed. Fig. 1 is a Waterfall model.

The first stage is requirements which is the stage of system requirements analysis. This stage begins with the process of seeking information through observation. This process is carried out to determine the needs of users or agencies. The next stage is an interview to get accurate information about system development needs. After conducting interviews, the next step is to process the information or data obtained. Then the internal library review process is carried out for system development needs.

The design stage is designing the appearance of the system architecture. This process is carried out to describe how the specific needs of the system display specifics. This process will detail the results of the system requirements data and apply them to the overall system architecture. The process begins with designing context diagrams, tiers, and data flow diagrams (DFD). Next is the database design process and system interface design.

The implementation phase is carried out after the design process is complete. This process implements the design into a programming language for developing a system. The programming language used is HTML, CSS, PHP, Bootstrap 4, Codeigniter 3, and Jquery 3 programming languages. The database management and storage process uses PHP: MySQL database.

The verification stage uses a programming language after the design implementation stage. This stage is a testing process to know whether the system has met user needs or needs further improvement. This stage is carried out using standard testing of ISO/IEC 25010 for the category of functional suitability using Black-box testing and system usability testing.

The next stage is maintenance. This stage is the stage of maintenance and repair if an error occurs in the system. This stage is carried out after the user uses the system. This stage can be carried out if damage or functional error occurs in the use process and further repair is needed. In this study, the maintenance phase was not carried out because the research only reached the system testing or verification stage.

The system testing in this study uses the ISO/IEC 25010 standard. This test standard was issued in 2011 by the Canadian Standards Association. ISO/IEC 25010 has two models for measuring system quality: the quality in use model and the software product quality model[7, 8].

Next is the software product, the quality model. The software product quality model is a test model applied specifically to test software. This model is used to test software because all its sub-characteristics can be used to test software or systems. The software product quality model consists of eight of them, namely the characteristics, namely: Functional suitability is a characteristic to test the extent to which the system or software runs according to user needs; Usability is a criterion to measure the extent to which the system has met the aspects of effectiveness, efficiency, and satisfaction with the use of the software system; Performance efficiency is a characteristic that measures whether the system uses relative energy or resources under certain conditions in its use; Reliability is a characteristic to measure the extent to which the system can perform its functions under specified conditions within a certain period of time; Compatibility is a characteristic that measures whether the system can exchange information with other systems properly and perform functions when the system is running as ordered in the same hardware or software environment or not; Security is a characteristic to measure how much the system is able to protect the security of information and data from users so that the system is in accordance with the type and level of authority; Maintainability is a characteristic that measures and represents the level of effectiveness as well as efficiency in the modification process adapted to changes and operational needs; Portability is a characteristic to measure the effectiveness and efficiency of the system on the success of the data transfer process from one device to another[9].

This study uses a software product quality model focusing on two characteristics, namely functional suitability and usability. Measurement of software quality ISO/IEC 25010 based on the software product quality model can be done by selecting a focus on specific characteristics to obtain measurement results based on the main aspects of system development so that it follows the initial objectives of the system development[9].

Tests based on the characteristics of functional suitability were carried out using Black-box testing. This test is measured using the Guttman scale. The Guttman scale is a scale that provides two answer choices, namely "Yes" or "No," "Good" or "Bad," "Never" or "Not yet," and so on[10]. Measurements using functional suitability characteristics are calculated using the feature completeness formula to measure system features' operational success and design[11].

$$X = \frac{I}{P} \tag{1}$$

Eq. 1 is an equation to determine the value of X or the results of the functional measurement of the system. The "I" symbol represents the number of successfully implemented features, and the "P" symbol represents the number of designed features. The results of the functional suitability measurement can be seen by reading the value of X. The interpretation of the measurements made is 1 (0 X 1). If the calculation result is close to 1, the developed product has been successful and meets the requirements.

Testing based on usability characteristics in this study uses the USE Questionnaire. USE Questionnaire is a type of questionnaire that can measure usability aspects subjectively based on usability, ease of use of the system by users, ease of learning the system to user satisfaction. This questionnaire uses a Linkert scale with five answers, namely Strongly Disagree (STS), Disagree (TS), Disagree (KS), Agree (S), and Strongly Agree (SS)[12]. The testing begins by demonstrating the developed system to users, then providing a questionnaire containing questions to be filled out by the user. The questionnaire filling data will be processed to calculate the average results of the user's answers. The formula used is as in Eq. 2 and Eq. 3.

$$ScoreGain = (JSS \times 5) + (JS \times 4) + (KSx3) + (JTS \times 2) + (JSTS \times 1) \tag{2}$$

$$Scoremax = JP \times JR \times 5 \tag{3}$$

Eq. 2 is used to find the score obtained from the usability test. The letter symbol "JSS" stands for the number of respondents who answered "Strongly Agree," "JS" for the number of respondents "Agree," "KS" for the number of respondents "Disagree," and "JSTS" for the number of respondents "Strongly Disagree." Furthermore, Eq. 3 is used to find the maximum number of scores from usability testing—symbol "JP" for Number of Questions and "JR" for Number of Respondents. When the acquisition score has been calculated, the next step is to calculate the usability test presentation using Eq. 4 to get the test results based on the usability aspect interpretation table.

TABLE 1 The usability scoring interpretation criteria.

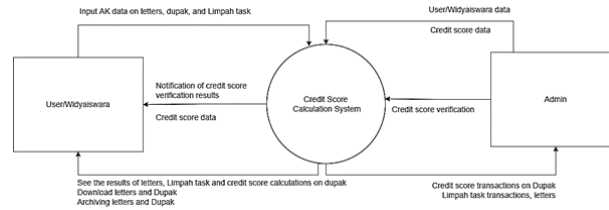| Yield (%)	Interpretation
< 20	Very not worthy
21 - 40	Less worthy
41 - 60	Decent enough
61 - 80	Worthy
81 - 100	Very worthy

FIGURE 2 The context diagram of Credit Score Calculation System.

$$PScore = \frac{Gain\ Score}{Max\ Score} \times 100\% \tag{4}$$

After getting the results of the calculation of the acquisition score presentation by calculating the acquisition score divided by the max score multiplied by 100%, the next step is to make a comparison based on the presentation results in the interpretation table[10]. Table 1 describes the gains to measure the usability aspect of the system being developed:

4 | RESULTS AND DISCUSSION

This research develops the Limpah feature and credit score verification (AK) for upgrading the web-based credit score calculation system for Widyaiswara functional position. The first stage in this research is the requirements or needs analysis stage. This stage begins with observations made on February 15, 2022, obtained information that the Makassar Religious Education and Training Center has developed a credit score calculation system previously. Furthermore, to obtain more accurate information related to the system being developed, an interview was conducted with one of the Widyaiswara at the Makassar Religious Education and Training Center on March 7, 2020. From the interview, information was obtained that the credit score calculation system that had been developed required the addition of an abundance task feature and credit score verification. After conducting interviews, the data collection and literature review needed for system development was carried out.

The next stage is the design stage. This stage is the stage of designing the data structure and software architecture, from the design of diagrams and databases to the system interface. The diagram design stages consist of context diagrams, tiered diagrams, data flow diagrams (DFD), and system interface displays. In Fig. 2 , the following is a context diagram of the development of Limpah tasks and credit score verification (AK) for upgrading the web-based credit score calculation system for the Widyaiswara functional position. This diagram is a diagram with the highest level where this diagram describes the entire process in the system.

Fig. 3 is a tiered diagram. The tiered diagram describes the process of data flow diagrams (DFD) from the highest to the lowest level. The diagram describes a multilevel structure that makes it easier for developers and stakeholders to understand the system's features or models.

Fig. 4 is a data flow diagram that describes the flow or network system with a database. This diagram is a level 1 DFD where this diagram illustrates the development of the previous context diagram. DFD level 1 in Fig. 4 shows the entire database process used to store data in the system.

After the design process, the next is implementing the design into a programming language whose results can be used by the user as a complete system. The following are the results of the system implementation:

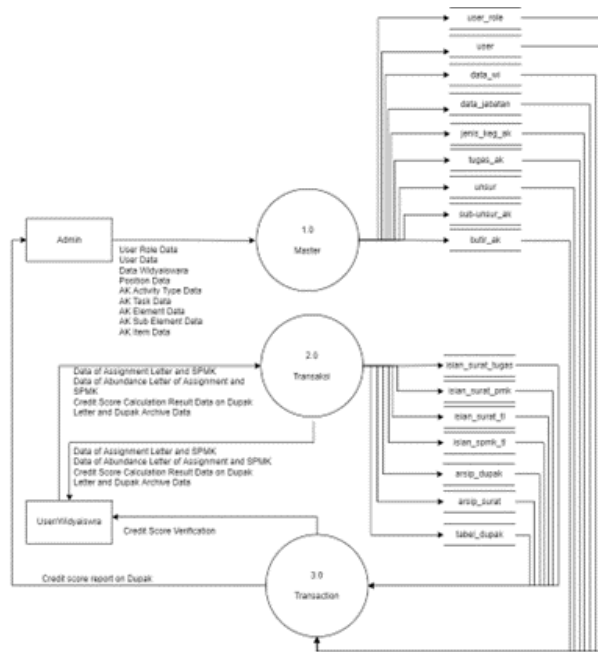**FIGURE 3** The tiered Diagram of Credit Score Calculation System.

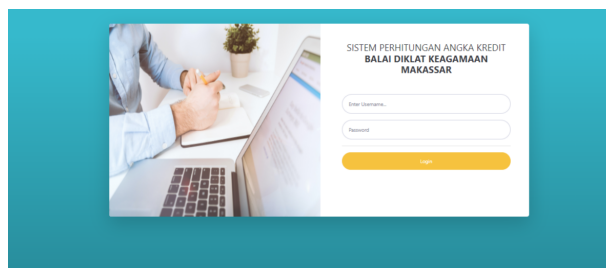**FIGURE 4** The DFD Level-1 of Credit Score Calculation System.

FIGURE 5 The login page.

4.1 | Loading Page

The login page is the first page that will appear when the user accesses the system. This page contains a form for filling in the username and password data. Users can enter the system if they have filled correctly in the username and password form. Fig. 5 show the login page.
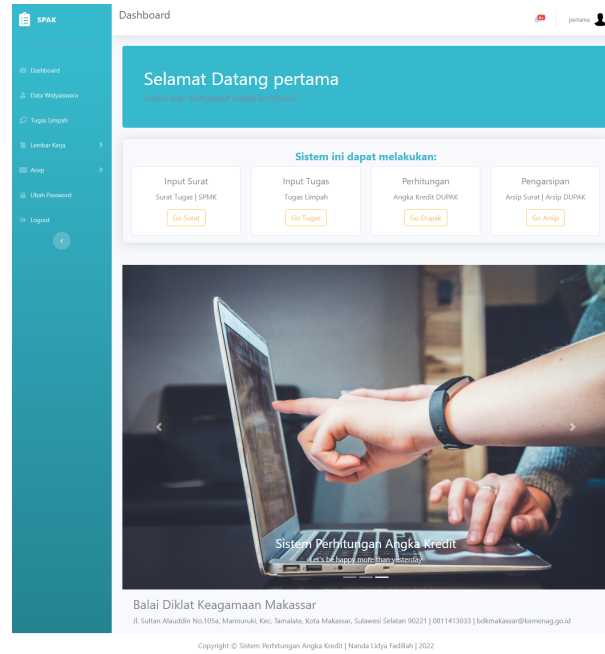
FIGURE 6 The dashboard page.

4.2 | Dashboard Page

The dashboard page is the page that appears when the user successfully logs into the system. This page provides a summary of the entire system. This page consists of a sidebar and shortcuts to the Widyaiswara data page, Limpah task, worksheets, archives, and change passwords to the logout button. Fig. 6 ilustrates the dashboard page.

4.3 | Limpah Task Page

The Limpah task page is the page for polling Limpah tasks. The page in Fig. 7 -a is the initial display page when the user accesses the Limpah task page. This page has access to select all Widaiswara position worksheets. The page in Fig. 7 -b is a page that can be accessed after the user selects the position option on the Limpah task start page. This page contains a selection of Limpah task assignment letters and abundant assignment SMPK. After selecting the type of letter, the user will go to the page in Fig. 7 -c. This page contains all of the Limpah assignments. On this page, the user can add data, edit data, delete data, and print data.

4.4 | Dupak Page

The Dupak worksheet page consists of two activities: filling out the letter sheet, and the input letter containing the credit number will be automatically inputted into the Dupak worksheet. The main page is capable of inputting data, deleting data, and printing data. Fig. 8 -ais the Dupak page. This page provides Dupak data previously inputted when the user inputs the data for the letter of assignment and the Limpah assignment, which contains credit numbers. This page provides calculation results and data features, deleting credit calculation data, printing Dupak, and verifying Dupak. Fig. 8 -b shows the Dupak printout the previous user inputted. This page displays Widyaiswara data and Dupak data, as well as the calculation of credit numbers in Dupak.

4.5 | Credit Score Verification Page

Fig. 9 is a credit score verification page that only system admins can access. This page contains a summary of each user's credit score. When the data is successfully verified, the data will move from the unverified data table to the verified data table. On this page, admins can verify data, comment on credit score input results, and preview the user's overall credit score.
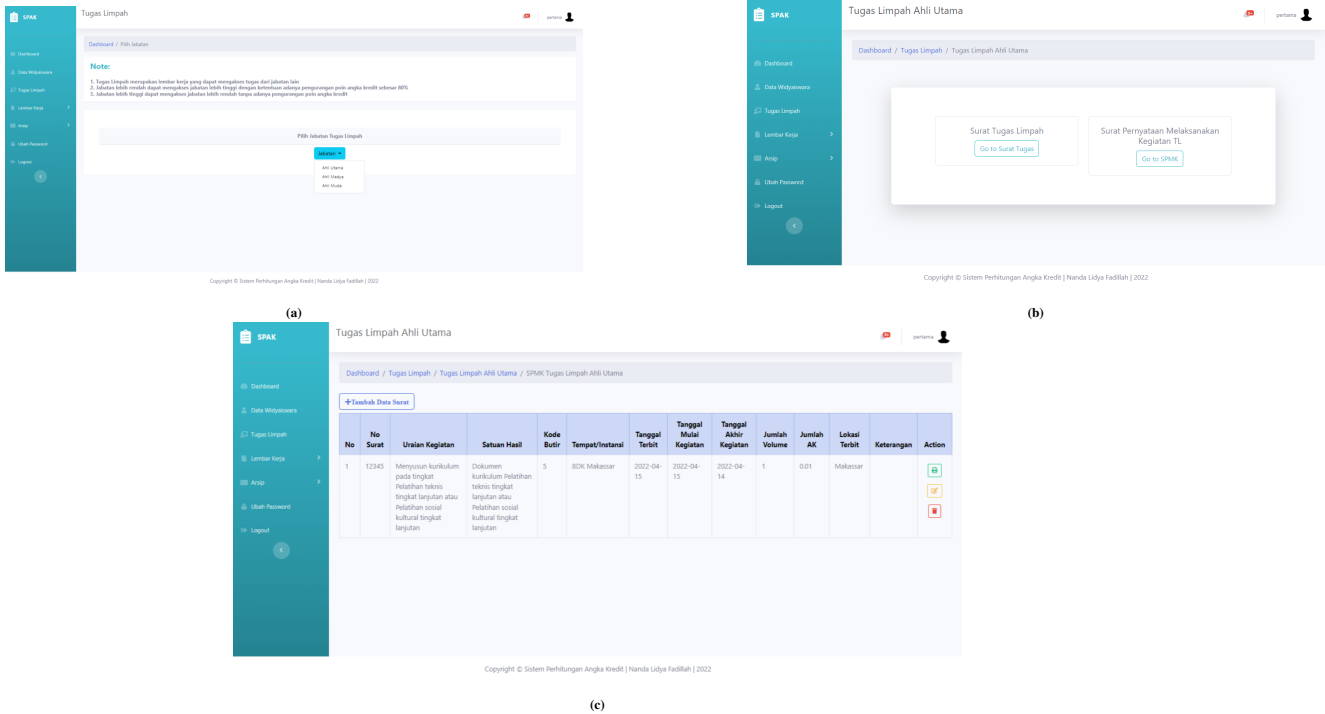
(a)

(b)

(c)

FIGURE 7 The limpah task page.

System testing is carried out using ISO/IEC 25010 software quality testing to see whether the system has been running well and as expected during development or still needs improvement. Testing ISO/IEC 25010 using a Software product quality model with functional suitability and usability characteristics. Testing with functional suitability characteristics uses Black-box testing, which two software experts test. This test has three sub characteristics of the test, namely functional completeness, functional appropriateness, and functional correctness. Table 2 is a table of test results for the sub-characteristics of functional completeness and functional appropriateness, which consists of 18 questions.

Table 2 is the result of testing the sub-characteristics of functional completeness and functional appropriateness. The following is a calculation of the sub-characteristics of functional completeness and appropriateness.

$$X = \frac{36}{36} = 1$$

Table 3 shows functional suitability test results with sub-characteristics of functional correctness. Table 3 contains 14 questions about the functional correctness of the system.

Table 3 is the result of testing the functional correctness sub-characteristics. It contains 14 questions and answers from software expert testers. The following is a calculation of functional correctness sub-characteristics.

$$X = \frac{28}{28} = 1$$

Based on the results of calculations from the sub-categories of functional completeness, functional appropriateness, and functional correctness, it is found that the value of X is 1. These results show that the development of Limpah task features and credit score verification for upgrading the web-based credit score calculation system for Widyaiswara functional position is declared good. Functionally each feature is based on the category of functional suitability testing. The next test is a test with usability characteristics. This test was carried out by distributing USE Questionnaire questionnaires to 20 Widyaiswara respondents at the Makassar Religious Education and Training Center with as many as 30 questions.

FIGURE 8 The limpah task page.

FIGURE 9 The dashboard page.

Table 4 is the result of usability testing. Based on the results of usability testing, it is known that the total number of answers strongly disagree (STS) is 0, disagree is 12, disagree (KS) is 42, agree (S) is 156, and strongly agree (SS) is 389. The test results are then entered into the formula, as follows.

$$ScoreGain = (389 \times 5) + (156 \times 4) + (42 \times 3) + (12 \times 2) + (0 \times 1) = 2712$$

$$Scoremax = 30 \times 20 \times 5 = 3000$$

$$Pscore = \frac{2712}{3000} \times 100\% = 90.4\%$$

TABLE 2 The function suitability testing result.

Function	Expected Results	Yes	No
	User Admin		
Login as admin	The login function works fine.	2	0
Change password	The change password function works fine.	2	0
Logout	The logout function works fine	2	0
Dashboard	Dashboard functions work well	2	0
Manage master data	The functions of adding, displaying, changing, and deleting master data work well.	2	0
Report on the number of letters and Dupak	The mail and Dupak report functions work well.	2	0
Verify Dupak data	The function of verifying Dupak data is running well	2	0
	User Widyaiswara		
Login as Widyaiswara	The login function to the credit score calculation system is running correctly	2	0
Change password	The function to change the password is working correctly	2	0
Logout	The logout function for Widyaiswara works fine	2	0
Dashboard	The dashboard function for Widyaiswara works well.	2	0
Add, change, delete letter and Dupak input data	The functions of adding, changing, deleting mail and Dupak input data work well.	2	0
Add, change, delete, input data Limpah task	The function of adding, modifying, deleting Limpah task input data works well	2	0
Credit score calculation	The function of calculating credit numbers is running well.	2	0
Submitting Dupak data verification	The function of submitting Dupak data verification is running well	2	0
Managing Widyaiswara Profile data	The function of managing Widyaiswara's profile data	2	0
Managing personal data on the Widyaiswara page	The function of managing personal data on the Widyaiswara page is running well	2	0
Print the results of making letters and Dupak	The function of printing the results of making letters and dupak works well	2	0
Total		**36**	**0**

TABLE 3 The function suitability testing result.

Function	Expected Results	Yes	No
	User Admin		
Identify user name and password	The function for logging in based on the type of user, the suitability of the username and password goes well	2	0
Display master user data	The function to display the master user data is running well	2	0
Showing master Widyaiswara data	The function to display Widyaiswara's master data is running well	2	0
Display job data	The function to display the credit score master data is running well	2	0
Manage master data	The function to display job master data is running well	2	0
Displaying detailed data on the number of mail reports	The function to display detailed data on the number of mail reports is running well	2	0
Displaying the detailed data on the number of Dupak reports	The function to display detailed data on the number of dupak reports is running well	2	0
Displaying data submit verification of Dupak report data	The function of displaying data submit verification of Dupak report data is running well	2	0
	User Widyaiswara		
Identify username and password	The function for logging in based on the type of user, the suitability of the username and password goes well	2	0
Displaying the input data for the Limpah task	The function of displaying the Limpah task input data is running well	2	0
Showing letter data input	The function of displaying letter data input is running well	2	0
Showing Dupak data input	The Dupak data display function is working fine	2	0
Displaying the results of data verification properly	The function displays the results of data verification properly	2	0
Displays the results of the input work in the format of the letter and Dupak documents that have been submitted	The function of displaying the input results of work into the letter and Dupak document formats that the system has provided is running well.	2	0
Total		**28**	**0**

The final result of the calculation based on the presentation of usability results is 90.4%. These results are then compared with the usability score interpretation table in Table 1 . It can be concluded that the system is declared very feasible and has met the expected usability aspects.

TABLE 4 The usability testing result.

Question	STS	TS	KS	S	SS
Usefulness					
This system helps activities to be more efficient	0	0	0	4	16
This system helps me to be more productive	0	0	0	4	16
This system has a significant impact on the tasks I do	0	0	2	5	13
This system gives me much control over my activities as a Widyaiswara.	0	1	1	4	14
This system makes my task easier	0	0	1	3	16
Using this system can save me time in doing tasks	0	0	1	5	14
This system suits my needs	0	0	1	3	16
The results of the process carried out by the system are in accordance with what I expected	0	0	0	5	15
Ease of Use					
This system is easy to use	0	0	3	6	11
This system is practical and straightforward to use	0	0	1	7	12
This system is easy to understand	0	0	2	5	13
This system only requires short steps in its use	0	0	2	7	11
This system can be adapted to your needs	0	0	2	4	14
There is no difficulty in using this system	0	1	2	8	9
I can use this credit score calculation system without written instructions	0	0	2	6	12
I see this system has been consistent when used	0	0	3	5	12
Both infrequent and regular users will love using this system	0	0	4	5	11
I can come back from mistakes quickly and easily	0	0	1	6	13
I can use this system successfully every time	0	0	1	7	12
Ease of Learning					
I learned this system quickly	0	1	1	8	10
I easily remember the use of the system	0	1	1	7	11
Using this system is easy to learn	0	0	2	6	12
I am proficient at using this system quickly	0	1	2	6	11
Satisfaction					
I am satisfied with this system	0	1	2	5	12
I am willing to recommend this system to friends	0	1	1	4	14
Using this system is a lot of fun	0	1	1	5	13
This system works the way I want	0	1	1	4	14
I am impressed with this system	0	2	0	4	14
I feel this system is what I need	0	1	1	6	12
I enjoy using this system	0	0	1	3	16
Total	**0**	**12**	**42**	**156**	**389**

5 | CONCLUSION

The research results from the development of the Limpah task feature and credit score verification for upgrading the web-based credit score calculation system for the Widyaiswara functional position are as follows; System testing uses ISO/IEC 25010 quality testing with functional suitability and usability categories. From this test, it is known that functional suitability with sub-characteristics of functional completeness, functional appropriateness, and functional correctness, which was tested by two expert examiners from the development of the Limpah task feature and Credit score verification for upgrading the web-based credit score calculation system shows that the system is functioning correctly. The calculation result is 1 (one). The next test category is usability, with the sub-characteristics of usefulness, ease of use, ease of learning, and satisfaction. The results of the tests that 20 respondents tested with 30 questions showed a system usability value of 90.4%. These results indicate that the system is feasible and meets the expected usability aspect. These results indicate that the development of the Limpah task feature, which functions as a credit score input feature that can be accessed outside the user's position, and the credit score lever feature to improve the web-based credit score calculation system has been running well and meets user needs.

CREDIT

Nanda Lidya Fadillah: Writing- Original Draft Preparation and Editing, Methodology, Formal analysis and Investigation. **Vivianti:** Review-Original Draft Preparation, Supervision, Conceptualization and Resources.

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