The Development of Web-Based Credit Transfer Applications in the Faculty of Science and Technology Universitas Terbuka
(A Case Study in the Information System Program)

Dian Nurdiana[1*], Adhi Susilo[2], Dwi Astuti Aprijani[3], Andri Suryadi[4]

[1,3,4] *Information Systems Study Program, Faculty of Science and Technology, Universitas Terbuka, Tangerang Selatan, Indonesia.*
[2] *Agribusiness Study Program, Faculty of Science and Technology, Fakultas Sains dan Teknologi, Universitas Terbuka, Tangerang Selatan, Indonesia.*

*Corresponding author email: dian.nurdiana@ecampus.ut.ac.id

Abstract

The implementation of credit transfer at Universitas Terbuka refers to the Rector's Regulation Number 119, 2018. This credit transfer could only be carried out once when students registered themselves at very first time. Recognition of credit transfer is accepted whn accomplishment of courses have been obtained from their previous universities. Through the provision of credit transfer recognition services, students are expected to be able to finish their study faster. Students can apply for credit transfer through the Faculty which would then be proceed by Study Program. Students are required to collect documents such as diplomas, transcripts, descriptions of courses at their previous university, and the submissions for courses intended to be transferred for credit. The documents which are in form of print out would later be processed in their respective Study Programs. During the process, the Study Program compiled the documents manually by recording and determining the courses approved for credit transfer. However, the study Program hasn't used a special application. Due to this limitation, several problems occurred in the process, such as the absence of filing the credit transfer application documents, the ineffectiveness of storing the credit transfer master block in the Study Program, and the large number of credit transfer applications. These problems often result in delays in the credit transfer process, thus disrupting academic services for students. Therefore, this study aims to develop a credit transfer application that can assist in the implementation of credit transfer in the Faculty of Science and Technology. The methodology used to develop this credit transfer application is the waterfall model. For design modeling using UML (Unified Modeling Language), while software testing uses Black Box Testing and usability and acceptance tests applied the PSSUQ (Post-Study System Usability Questionnaire) method. From the results of the tests, it showed that Black Box Testing got test results of 100%, while the usability and acceptance tests using the PSSUQ method got 68% of respondents. The conclusion of this study showed that the application is ready to use and the users Agree/Good/Like on the development of a web-based credit transfer application at the Faculty of Science and Technology of the Universitas Terbuka (case study of Information Systems Study Program).

Kata kunci: credit transfer, web, waterfall, black box testing, PSSUQ.

1. Introduction

The recognition of Past Learning (RPL) is an acknowledgment of a person's learning achievements obtained from formal or non-formal education, and/or work experience into formal education. The RPL's objective is to provide opportunities for the community to enter the formal education system or be equated with certain qualifications based on education formal, non-formal, informal or work experience in very special or rare fields and needed by the state such as lecturers, instructors, teachers, health workers and other very specific professions (Regulation of the Minister of Research, Technology, 2016).

The Universitas Terbuka (UT) is the 45th state university that implements an open and distance learning system. The Universitas Terbuka provides recognition of past learning to the students which is called a credit transfer system. The recognition of credit transfer at the Universitas Terbuka is an acknowledgment of the learning experience and graduation of courses that have been gained by the students from another university. Regarding to the implementation of the credit transfer system, the students are expected to be able to take a faster length of study (Yani et al., 2012).

The implementation of credit transfer at the Universitas Terbuka refers to the Rector's Regulation Number 119 of 2018 which could only be done when students register for the first time as new students. The students must apply for credit transfer through the Faculty no later than 30 days after the course registration payment is closed and then the application would be processed in the Study Program. The students would collect documents for credit transfer such as diplomas, transcripts, course descriptions from the previous campus, submissions for courses that would be transferred for credit. Then the file will be processed in each study program. During the process, the study program does it manually. To record and determine the courses that are approved for credit transfer, the study program have not used a special application. Owing to this limitations, several problems appeared in the process, such as the inadequacy of place to archive the credit transfer application documents, the ineffectiveness of storing the credit transfer master block, and the large number of credit transfer applications in each semester which would reach around 50 submission files in each Study Program in FST and some more other problems.

Whereas, the role of information system applications in universities in every internal activity is one of factors of fruitfulness and advancement of higher education (Aswati et al., 2015). Then, the use of the application would facilitate the credit transfer process that is currently running. Thinking of this responsibility, there were some previous relevant studies on credit transfer that have been carried out; Credit transfer applications are made using PHP as a credit transfer information system solution at the Darma Persada university information system study program (Nur & Aulia, 2018), Analysis of Implementing Past Learning Recognition (RPL) to Continuing Formal Education And Recognition Equalized With KKNI Qualifications (Simatupang et al., 2017), and Past Learning Recognition Development Model to Strengthen Indonesia's National Qualifications Framework (bagiastuti et al., 2020).

Based on the description above, it is necessary to develop a credit transfer application at the Faculty of Science and Technology. This would be expected to realize by conducting a relevant study through a case study in the Information Systems Study Program. The application developed is a web-based application. A web application is an application that is stored and executed in a web server environment (Budi & Heryanto Imam, 2012). The users here are expected to be able to access credit transfer applications anywhere and anytime.

2. Methods

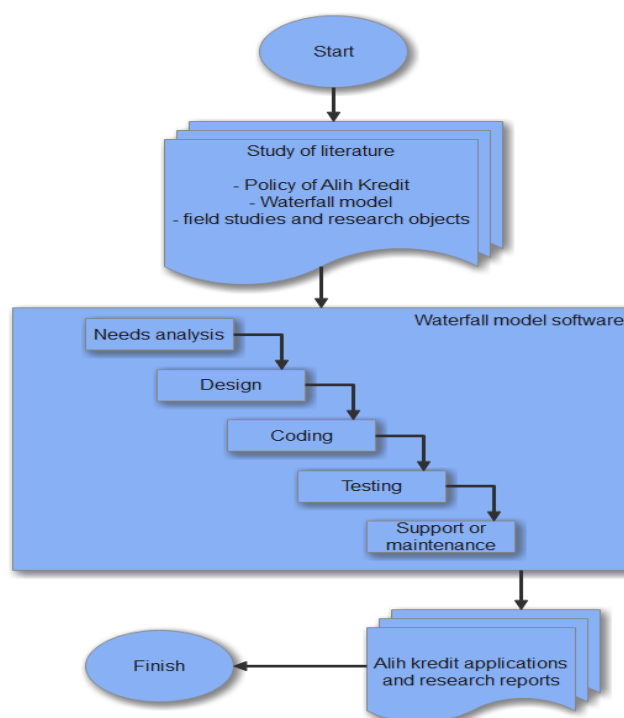The research stages of the credit transfer application can be seen in the following Figure 1.

Figure 1. Researh Stages

The stages of research that have been described can be explained as follows:

a) Literature Study
The first stage in this research is literature study. In this literature study, there are three stages; the application of credit transfer and the waterfall model as software, then the use of the waterfall model that would be used and field studies along with the research object.

b) Waterfall Model Software

The development of this credit transfer application applied the waterfall model. The waterfall model is a traditional software development process commonly used in software projects. There are five stages in the Waterfall Method, they are; the requirements analysis and definition, the system and software design, the implementation and unit testing, integration and system testing, and the operationa and maintenance (Sommerville, 2011). This is a sequential model; therefore, the completion of one set of activities leads to the start of the next activity. Figure 2 below is a waterfall model software.
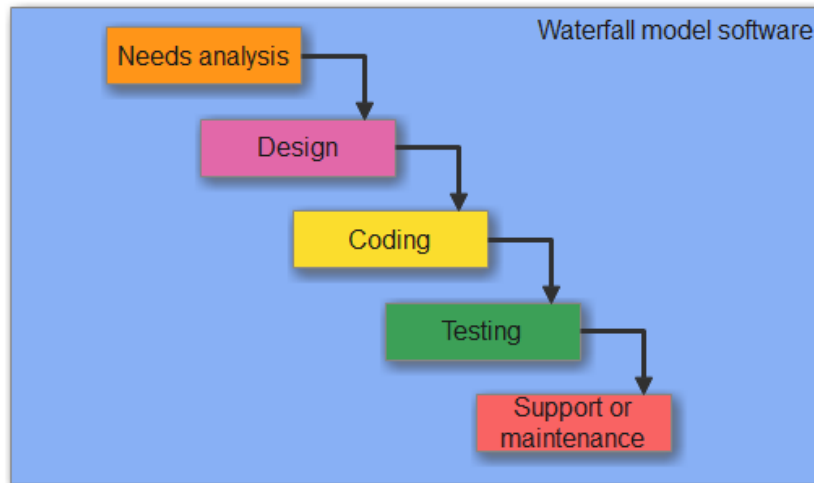
Figure 2 Waterfall Model

According to (Rosa Arini Sukamto & Salahuddin, 2018), "Waterfalls are often called linear sequential models or classical lifelines". The waterfall model provides a sequential approach to the software lifeflow starting from:

1) Needs analysis
   The process of gathering requirements is carried out intensively to specify software requirements in odder to gain the appropriate software needed by the user required to be documented at this stage.

2) Design

   A multi-step process focuses on the design of a software program including data structures, software architecture, interface representation, and coding procedures.

3) Coding
   The design must be translated into software. The result of this stage is a computer program in accordance with the design that has been made in the previous stage.

4) Testing
   Testing focuses on software, logically and functionally to ensure that all parts have been tested. This is done to minimize errors and ensure the output produced is as desired.

5) Support or maintenance
   It cannot be ruled out that there might be a possibility of a software change when it has been sent to the user. Because when some errors occured and were not detected during testing or when the software needs to adapt to a new environment, the support and maintenance stages can repeat the development process starting from the specification analysis for software changes that already exists, but not to create a new program.

3. Results

3.1. Need Analysis

Based on the mechanism and problems faced by the Universitas Terbuka in the process of credit transfer, the transfer takes a long time. Furthermore, students inability to monitor the up to date process prolongs the

accomplishment of the transfer. Henceforth, an advancement need to be conducted to this need by providing functional requirements. Functional requirements are types of requirements that contain processes that can be carried out by the system or application to be developed. The current credit transfer mechanism at the University would serve as a reference for making functional requirements. The results of the functional requirements analysis of Web-Based Credit Transfer Applications at the Faculty of Science and Technology (A Case Study of Information Systems Study Program) are shown in the following.

- The developed appication is a web-based application.
- The developed applications can be accessed anywhere and anytime
- The developed application can be accessed by several users, like admin, head of study program, faculty staff, and lecturers.
- The developed application is user friendly.This means that the application is easy to use and can assist in the process of transferring credit in the study programs. The application has additional supporting functions such as the existence of a credit transfer master block and credit transfer data storage.

3.2. Desaign

The design stage is the following stage conducted based on the software development methodology using the waterfall. At this stage, the results of the needs analysis would be converted or would be translated into a model used in the next stage. The designs developed in this study include business process design, database designs, mockup designs or application interface designs, etc.

1. Database Design

According to (Connolly & Begg, 2005) database is the collection and descrption of the data which are logically divided and connected to meet the information needs of an organization. Meanwhile, according to (Hoffer et al., 2011) the database is the collection of organized data which are logically related. Figure 3 is the structure of the credit transfer application database.
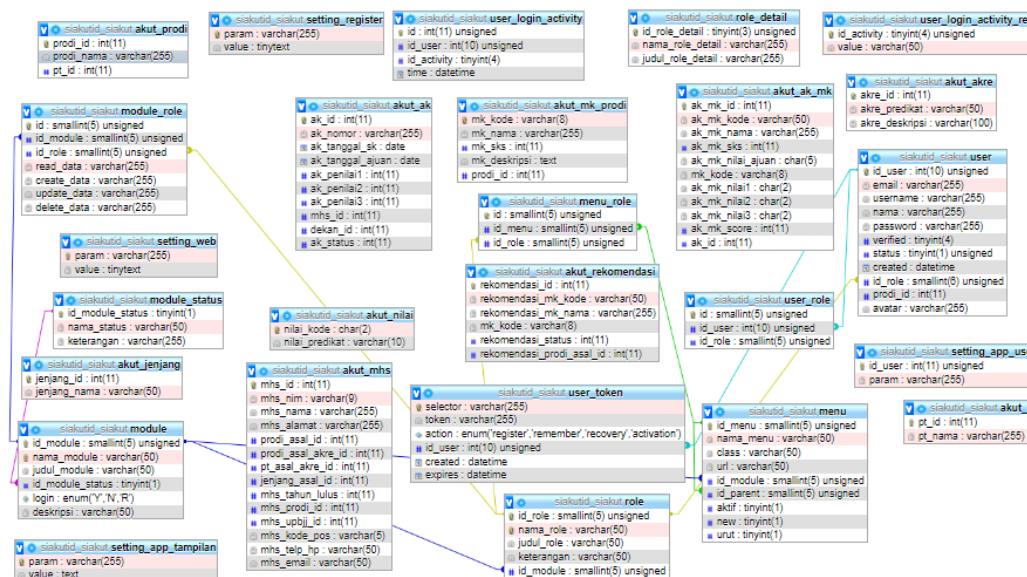

Figure 3 The Credit Transfer Application Database

1) Use Case

Tohari (2017) stated that the use cases are a series or description of a group that are interrelated and form a system on a regular basis carried out or supervised by an actor.

a) The Definition of an Actor

The definition of an actor in a credit transfer application can be seen as Table 1.

Table 1. Definition of an Actor in a Credit Transfer Applicatio

Number	Actor	Description
1	An *Admin*	The person who own the highest right access who can access all the menus in the application.
2	Faculty Staff	The person in charge of entering basic data such as credit transfer rules, course description input, university input, student input, course submissions and credit transfer reports.
3	The Head of Study Program	The person in charge of verifying the credit transfer and making a credit transfer report.
4	Lecturers	The person in charge of verifying the credit transfer

b) The Definition of the Use Case

The description of the use case definition in the credit transfer system can be seen as Table 2.

Table 2. Description of the Use Case Definition in the Credit Transfer

Number.	Use case	Deskripsi
1	Login	The logging process of each actor.
2	Credit transfer rule input	The process to input documents related to the rules of credit transfer.
3	Course description input	The process to input the course description of the Study Program of Information System.
4	The university input	The process to input previous university data.
5	Study program input	The process to input the previous study program data.
6	Student input	The process to input students' data who would apply for credit transfer.
10	Proposed ourse Input	The process to input the proposed courses that would be transferred for credit.
11	Information System courses input	The process to input a master from the Study Program Information System courses.
12	Course verification	The verification process to submit credit transfer applications proposed by the students.
13	Credit transfer report	The process of making a credit transfer report.

The use case of the developed credit transfer application can be seen as Figure 4.

Figure 4. Use Case of the Developed Credit Transfer

c) The Component Diagram

Rosa A. Sukamto & Salahuddin (2013) stated that the component diagram is the description of a collection of interdependent components. The component diagrams focus on the components required in the system.

The basic components usually found in a system are as follow:
a) user interface which handles the display;
b) business processing which handles business process functions;
c) data which handle data manipulation;
d) security which handles the system security.

The following Figure 5 shows the diagram components of a credit transfer application.
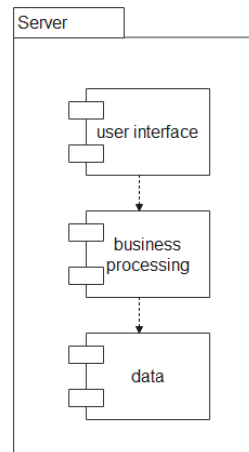
Figure 5 Diagram of Components of a Credit Transfer

d) Deployment diagram

Sulistyorini, 2009 stated that the deployment diagram describes the configuration of the application when it is run. It contains knots or nodes and the existing components. The following Figure 6 is the deployment diagram of the credit transfer application.
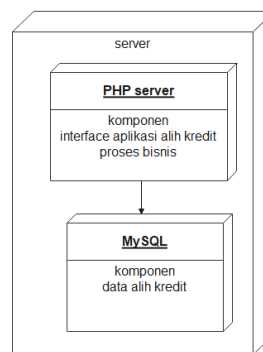
Figure 6. Deployment of Diagram of the Credit Transfer

3.3. Coding
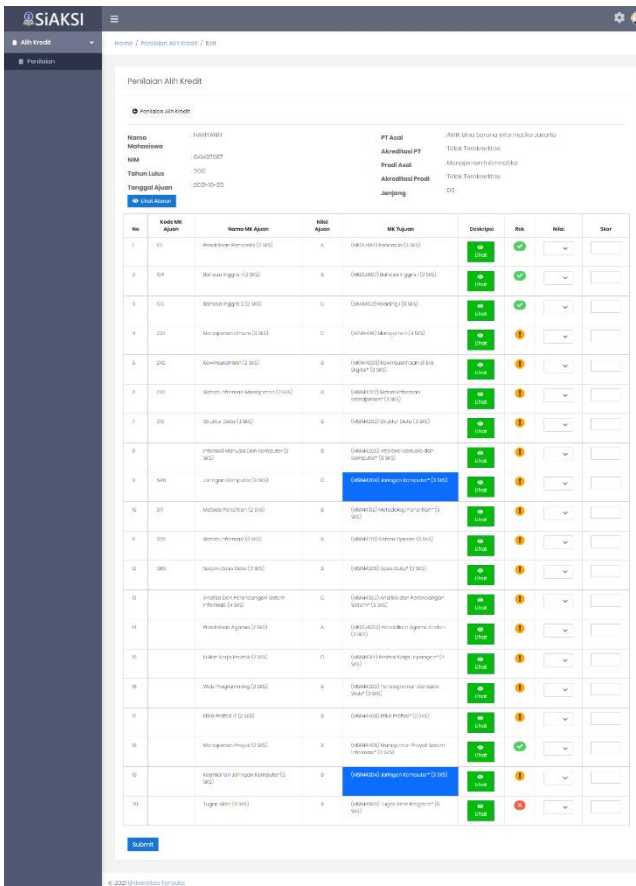
Coding is the most important stage in establishing a system. The coding stage in developing this system uses:
- PHP. PHP (Hypertext Preprocessor) is a programming language functioning to create dynamic websites and web applications. Unlike HTML which can only display static content, PHP can interact with databases, files and folders, thus making PHP able to display dynamic content from a website (Yuliano, 2007).
- CodeIgniter, CodeIgniter is a PHP framework that can be used to simplify scripts and optimize PHP functions. This book is intended for web developers who are eager to develop the potential of PHP-based programming (Enterprise, 2015).
- MySQL. MySQL is a software functioning to create, manage, and organize the databases. With MySQL, you can create your own database to store and manage company data such as employee data, finance and accounting, assets, etc. (Raharjo, 2011).

- Bootstrap. It is a free and open source CSS framework for designing websites and web applications. This framework contains HTML and CSS based design templates for typography, forms, buttons, navigation, and other interface components, as well as optional JavaScript extensions.
- PhpSpreadsheet. It is a PHP library that can be used to read and write Excel files, so you can use this library for reading or writing Excel files using PHP commands.
- DataTables. It is a jquery plugin that is used to display data in grid form.
- Bootbox, a JavaScript library that can be used to create dialog boxes using the Twitter Bootstrap Modal.
- jQuery. a cross-platform JavaScript library designed to simplify client-side scripting in HTML.
- Javascript, a high-level and dynamic programming language. JavaScript is popular on the internet and it can work in most popular web browsers such as Google Chrome, Internet Explorer, Mozilla Firefox, Netscape and Opera

The results of the codings produces an application and displays as Figure 7.

- College input
- Study program Input
- Courses Input
- Student input
- Lecturer input
- Submission input
- Print
- Validation
- Evaluation/scoring

Figure 7. The Appearance of Credit Transfer Application

The application is developed in a user friendly manner which means that it is easy to use and helpful to assist in the process of transferring credit in study programs. This application is equipped with recommendations for courses that have been approved, rejected or untaken courses (there is no history of previous submissions) to help the assessors in assessing the courses. In addition, the application is equipped with a color feature as the sign of the existence of more-than – one submission courses.

3.4. Testing

a) Black Box Testing

Rosa & Shalauddin, 2011 stated that black box testing is a software testing in terms of functional specifications without testing the design and program code. This testing is intended to determine whether the functions, inputs, and outputs of the software are in accordance with the required specifications. Table 2 is Black box testing is conducted by making a test case that tried all functions using the software whether it meets the required specifications.

Table 2. Black Box Testing

No.	Testing Scenario	Expected finding	Observation	Description
1	Login page	If user's data and password are correctly entered	The application accepts and displays the next page.	Accepted
2	Main page	The displayed page is equipped with existing menus	Displaying the correct main page	Successful
3	Adding user	If the entered data is complete and correct, the system will proceed the data for storage	The data entered has been complete and correct, the system will then process the data for storage	Successful
4	Adding role user	If the entered data is complete and correct, the system will proceed the data for storage	The data entered has been complete and correct, the system will then process the data for storage	Successful
5	University appearance	If add data is clicked and the name of the university has been entered, click submit. The university data will be added.	Click 'add data' button, then input the university name, click 'submit'. The university data is then stored.	Successful
6	Study program page	If 'add data' is clicked, the study program name is entered and the choice of college appears, then click 'submit button'. The study program data will be stored.	Click 'add' button, input the study program name and the university choice. Then click 'submit' to store the study program data	Successful
7	Course page	If 'add data' is clicked, input the data of course name, credits and description. Click 'submit'. Then the course data is added and stored.	Click 'add data', input the name of the course, credits and description, then click 'submit' to store the data.The number of the data increase.	Successful
8	Student page	If 'add data'is click, fill in students' name, number, address, postal code, previous study program, accreditation of previous study program, accreditation of previous university, previous strata, graduation year, study program, telephone number and email. Then click the submit button, the students' data will be stored.	Click 'add data', then fill in students' name, number, address, postal code, previous study program, accreditation of previous study program, accreditation of the previous university, previous strata, graduation year, study program, telephone number and email. Then click the submit button. Students' data is saved	Successful
9	Lecturer page	If 'add data' is clicked, fill in students' name, email, new role password, repeat the password. Then click 'submit' to save lecturers' data.	Click 'add data', fill in students' name, email, new role password, and repeat the password. Then click 'submit'. The lecturer' data is saved and increase.	Successful
10	Submission page	If 'add data' is clicked, select the 'student', fill in the date of submission, fill in appraiser 1, fill in appraiser 2. Fill in the code, name, credits, grade of	Click 'add data', select the student, fill in the date of submission, assessor 1, assessor 2 successfully. Fill in the code and the name of intended course, credits, score and	Successful

No.	Testing Scenario	Expected finding	Observation	Description
11	Evaluation /scoring page	proposed course, and select the data conversion method. Then one application data is stored. Click '+' button then the next line appears. To end the submission, click 'submit'. The student submission data is stored.	select data conversion method. Then one application data is stored	Successful
		If entry is clicked, the student credit transfer assessment page appears.	Click '+' button then the next line appears.	
			Click 'entry', then the student credit transfer assessment page appears	
		If 'view rules' button is clicked, the rule information will appear	Click 'view the rules, the information of rules appears.	
		If 'view' on the description is clicked, the course description will appear	Click 'view' on the course description and it will appear	
		If the 'score' is selected, the selected score will be stored	Select 'score', the selected score is stored	
		Click 'submit' to save all the assessment and return to the scoring page.	Click 'submit' to save all score and return to the assessment page.	
12	Validation page	If 'entry' is clicked, the student's credit transfer authentication page appears	Click 'entry', the students' credit transfer authentication page will appear.	Successful
		If 'view the rules', the rule information will appear	Click 'view the rules' in order that the rule information appears.	
		If 'view' on the description is clicked, the course description will appear	Click 'view' on the description, then the course description will appear.	
		If 'score' is clicked and fill in the score, the selected assessment and score will be stored.	Select 'score' and fill in the score. The selected assessment and score are stored.	
		Click 'submit' to save save all scoring and return to the score page.	Click 'submit' to save all scoring and return to the assessment page	
13	Print page	If 'print' is selected, excel file will be downloaded.	Click 'print' to download an excel file	Successful

b) The Usability dan Acceptance Test

The Usability dan Acceptance Test stage is the activity aiming to perform functional validation and acceptance of applications to the users. The testing is focused on the type of validation and testing of the required functions to determine whether the application is running well and in accordance with the user needs. One of the application tests is usability test. In this study, usability test was carried out using the PSSUQ (Post-Study System Usability Questionnaire) method. PSSUQ is a research method using a questionnaire instrument to assess usability through four

assessment categories, they are the overall category, system usefulness, information quality, and interface quality (Lewis, 2006).

The questionnaires were distributed to the users comprising of 4 users, including 2 lecturers, 1 head of study program, and 1 faculty staff. The answer choice "strongly disagree" was given as the lowest score 1 and the answer "strongly agree" was given the highest score 4. The questionnaire was processed using the criteria of Likert scale with the interpretation of the score based on the interval. The scoring as given in Table 3, PSSUQ questionnaire in Table 4, and questionnaire result in Tabel 5.

- Score 0% – 19.99%   = Strongly disagree/bad/strongly less)
- Score 20% – 39.99% = Disagree / Not good)
- Score 40% – 59.99% = Fair / Neutral
- Score 60% – 79.99% = Agree/Good/Like
- Score 80% – 100%   = Strongly (agree/Good/Like)

Tabel 3. Scoring

Aswers	Score	Descripton
SA	4	Strongly Agree
A	3	Agree
D	2	Disagree
SD	1	Strongly Disagree

Table 4. PSSUQ Questionnaire

Number.	Questions	Answers			
		SA	A	D	SD
1	Overall, I am satisfied with the easiness of using the system.				
2	The system is easy to use				
3	I can effectively complete the tasks and work scenarios using this system.				
4	I can quickly accomplish the tasks and work scenarios using this system.				
5	I can efficiently complete the tasks and work scenarios by using this system.				
6	I feel comfortable using this system.				
7	It's easy to learn to use this system.				
8	I believe that I can quickly be productive using this system.				
9	The system gives a clear error message to let me know how to fix the problem.				
10	Whenever I make a mistake while using the system, I can recover it easily and quickly.				
11	The information (online help menu, message board and documentation) provided by the system is clear.				
12	It is easy to find the information I need.				
13	The information provided by the system is easy to understand.				
14	The information in the system is effective in helping me complete the tasks and work scenarios.				
15	The organizational structure of the information on the system screen display is clear.				
16	*The interface (display) of the system looks comfortable.*				
17	I enjoy using the interface of the system.				
18	This system has all the functions and capabilities as expected.				
19	Overall, I am satisfied with this system.				

Tabel 5. Questionnaire Result

Questions	User 1	User 2	User 3	User 4	Total
P1	4	4	3	4	15
P2	4	4	4	4	16
P3	4	4	3	4	15
P4	4	4	3	3	14
P5	4	4	4	3	15
P6	4	4	3	3	14

Questions	User 1	User 2	User 3	User 4	Total
P7	4	4	3	4	15
P8	4	4	3	4	15
P9	3	3	3	3	12
P10	3	3	3	3	12
P11	3	4	4	3	14
P12	4	3	3	4	14
P13	4	4	3	4	15
P14	4	4	4	3	15
P15	3	4	4	4	15
P16	4	4	3	4	15
P17	4	4	4	4	16
P18	4	3	3	4	14
P19	4	3	3	4	14
Total					**275**

The questionnaire are calculated using the Likert scale and the result was obtained 68%, which means that the respondents Agree/Good/like the development of web-based credit transfer applications at the Faculty of Science and Technology of the Universitas Terbuka (a case study of Information Systems Study Program).

4. Conclussion

In accordance with the needs analysis on credit transfer limitation in the Faculty of Science and Technology (a case study of Information Systems Study Program), a solution to the problem was produced by developing a web-based credit transfer application which is helpful in accomplishing the process of credit transfer. The methodology used to develop credit transfer applications is the waterfall model. The design modeling applied UML (Unified Modeling Language), while software testing used Black Box Testing and usability testing is carried out using the PSSUQ (Post-Study System Usability Questionnaire) method. From the obseervation of the Usability and Acceptance Test to users consisting of 4 users, including 2 lecturers, 1 head of the study program, and 1 faculty staff, the study obtained a result of 68% which means users Agree/Good/like the development of web-based credit transfer applications at the Faculty of Science and Universitas Terbuka Technology (a case study in Information Systems Study Program).

References

Aswati, S., Mulyani, N., Siagian, Y., & Syah, A. Z. (2015). Peranan sistem informasi dalam perguruan tinggi. *JURTEKSI ROYAL Edisi2*.

Bagiastuti, N. K., Damayanti, I. A. K. W., & Astuti, N. N. S. (2020). Model Pengembangan Rekognisi Pembelajaran Lampau Untuk Memperkuat Kerangka Kualifikasi Nasional Indonesia. *Prosiding Seminar Nasional Terapan Riset Inovatif (SENTRINOV)*, *6*(2), 554–562.

Budi, R., & Heryanto Imam, R. K. (2012). Enjang, Modul Pemrograman Web HTML, PHP, DAN MYSQL. *Bandung: Modula*.

Connolly, T. M., & Begg, C. E. (2005). *Database systems: a practical approach to design, implementation, and management*. Pearson Education.

Enterprise, J. (2015). *Membuat website PHP dengan CodeIgniter*. Elex Media Komputindo.

Hoffer, J. A., Ramesh, V., & Topi, H. (2011). *Modern database management*. Upper Saddle River, NJ: Prentice Hall,.

Lewis, J. R. (2006). Usability testing. *Handbook of Human Factors and Ergonomics*, *12*, e30.

Nur, S., & Aulia, S. (2018). Solusi Sistem Informasi Alih Kredit pada Program Studi Sistem Informasi Universitas Darma Persada. *Jurnal Sains & Teknologi Fakultas Teknik*, *8*(1), 1–8.

Peraturan Menteri Riset, Teknologi, dan P. T. nomor: 26 T. 2016. (2016). *2016 - 26 Rekognisi Pembelajaran Lampau*. http://kelembagaan.ristekdikti.go.id/wp-content/uploads/2016/08/PERMEN-NOMOR-26-TAHUN-2016-TENTANG-REKOGNISI-PEMBELAJARAN-LAMPAU-SALINAN.pdf

Raharjo, B. (2011). *Belajar otodidak membuat database menggunakan MySQL*.

Rosa, A. S., & Shalauddin, M. (2011). *Modul Pembelajaran Rekayasa Perangkat Lunak (Terstruktur dan Berorientasi Objek)*.

Simatupang, D., Suparman, J., & Cahyono, F. B. (2017). Analisis Penyelenggaraan Rekognisi Pembelajaran Lampau (RPL) Untuk Melanjutkan Pendidikan Formal Dan Pengakuan Disetarakan Dengan Kualifikasi KKNI Tertentu Di STIP Jakarta. *Meteor STIP Marunda*, *10*(2), 16–29.

Sommerville, I. (2011). *Software Engineering (Rekayasa Perangkat. Lunak)*. Erlangga.

Sukamto, Rosa Ariani, & Shalahuddin, M. (2013). Rekayasa perangkat lunak terstruktur dan berorientasi objek. *Bandung: Informatika*, *3*.

Sukamto, Rosa Arini, & Shalahuddin, M. (2018). *Rekayasa Perangkat Lunak (Edisi Revisi)*. Bandung: Informatika Bandung, 31œ33.

Sulistyorini, P. (2009). Pemodelan visual dengan menggunakan uml dan rational rose. *Dinamik*, *14*(1).

Tohari, H. (2017). *Astah-Analisis serta perancangan sistem Informasi melalui pendekatan UML*.

Yani, D. E., Pertiwi, P. R., Fadila, I., Puspitasari, K. A., & Huda, N. (2012). Tracer study pada Program Studi S1 Agribisnis FMIPA-Universitas Terbuka. *Jurnal Pendidikan Terbuka Dan Jarak Jauh*, *13*(2), 94–105.

Yuliano, T. (2007). Pengenalan Php. *IlmuKomputer. Com*.