OPEN ACCESS
ISSN 2460-9056
http://socj.telkomuniversity.ac.id/ijoict/

Intl. Journal on ICT
Vol. 9, No. 1, Jun 2023. pp. 57-72
doi: doi.org/10.21108/ijoict.v9i1.723

Implementation of the Learner Centered Design Method and the Personality Approach (Case Study: Redesigning The Interface of Mobile LMS Tel-U)

Kurniawan Malik Ibrahim[1], Ati Suci Dian Martha[2*], Dawam Dwi Jatmiko Suwawi[3]

[123]*School Of Computing, Telkom University*
Jl. Telekomunikasi No.1 Terusan Buah Batu, Bandung, Jawa Barat, Indonesia, 40257

[1]kurniawanmalik@student.telkomuniversity.ac.id, [2]aciantha@telkomuniversity.ac.id,
[3]dawamdjs@telkomuniversity.ac.id

Abstract

The Mobile LMS Tel-U is an e-learning platform developed by Telkom University to support the learning process. However, it still requires more demand from Telkom University students. Usability evaluation was conducted on twelve students using the System Usability Scale (SUS), resulting in a score of 43.5. Interviews and observations revealed interface problems on the dashboard, material, grades, and quizzes. This study aims to redesign the mobile LMS Tel-U interface using the Learner-Centered Design method and incorporating a personality approach by categorizing students into introverts and extroverts. Designing based on personality groups acknowledges the differences in interface design preferences and the relationship between personality and e-learning interface design. This approach yields two different interface designs, one for introverted students and one for extroverted students. The LCD method determines student needs in supporting the learning process. The redesigned interface's usability was evaluated using SUS to assess its appropriateness for students' learning needs. The study shows an average increase in usability scores of 80.4. The introverted student group achieved a usability score of 81, while the extroverted student group obtained a score of 80. Thus, the LCD method and personality approach effectively enhance the usability of distance learning applications (e-learning).

Keywords: LMS, e-learning, mobile application, user interface, learner-centered design, personality.

I. INTRODUCTION

THe LMS Tel-U mobile application is an online learning platform developed by Telkom University to support the regular study programs and distance education programs learning process at Telkom University. Mobile e-learning is considered more flexible because mobile devices are more affordable compared to personal computers and easy to carry everywhere, thus enabling students to enhance their knowledge and skills [1]. To determine the usability level of the LMS Tel-U mobile application, usability evaluations, observations, and interviews were conducted with 12 student respondents. The student respondents came from Telkom University students who had used this application with an Android-based smartphone. After evaluating the usability using the System Usability Scale (SUS), a score of 43.5 was obtained, on the Grade Scale, it received an "F" rating, on the Adjective Rating, it received an "Ok" rating, and on the Acceptable

Received on 13 Jun 2023. Revised on 28 June 2023. Accepted and Published on 12 July 2023.

Range, it received a "Not Acceptable" rating. These results indicate a significant difference between the usability level of the LMS mobile application (SUS score = 43.5) because the level of good usability for websites or applications (SUS score = 68.2) [2].

The System Usability Scale (SUS) is a method for quantitatively measuring the usability level of a website/application, developed by John Brooke. SUS consists of 10 questions with ratings on a Likert scale from 1 to 5, where 1 indicates "Strongly Disagree" and 5 indicates "Strongly Agree.". This method was chosen because according Ependi, et al [3] shown that the System Usability Scale is better than Heuristic Evaluation because it only requires a number of respondents to determine whether an application can be considered usable or not, while still maintaining good validity. After conducting the usability evaluation using SUS, brief interviews were conducted with the respondents regarding the main issues in the mobile application interface of mobile LMS Tel-U. Usability problems were found in the dashboard, nilai, quiz and grades menu. Here are the interface issues found on this app, and for detail can see in appendix at masalah antarmuka folder.

TABLE 1
USER INTERFACE PROBLEM FROM LEARNER INTERVIEW

No.	User Interface Problem
1.	There needs to be a change in interface design, especially on the dashboard menu, quizzes, materials, and grades.
2.	The interface is still too old-fashioned for an e-learning interface at this point
3.	Only used this application a few times, because they felt uncomfortable, the respondent returned to using the website version of CeLOE.
4.	A mobile-based learning application that should be easier to use than a website-based one.
5.	Simple but effective application features.
6.	A more user friendly application, especially for those who are using the application for the first time.
7.	Can easily access material, get lecture information, and study anytime and anywhere.
8.	There are several features that are not used too much, and some features have the same function but are placed in two different places.
9.	The dashboard menu display does not immediately appear when entering the application, but instead goes to other features which are assessed by students as lacking information but instead is placed in the main display section when entering this application.
10.	The interface design is still too old-fashioned, and not comfortable to use for a long time
11.	The material menu should not just download material, but maybe you can add introductory material and learning support videos so that students know what material will be studied, besides that when they want to download the material file they also have to click on the material file, and click the open button again. according to the respondent, to download the material file, one click of the material download button does not need 2 stages which confuses the user.
12.	The display value feature is too confusing and there are too many stages to complete one task.

In Dashboard menu (Fig.1) there is a problem where users had to go through three stages to complete a single task and the user interface is not very informative.

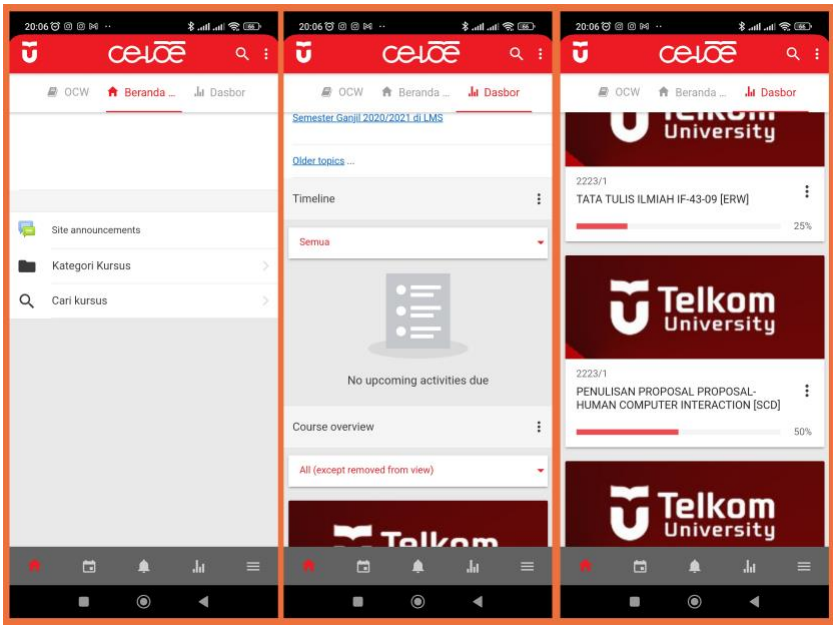

Fig. 1. User interface problem 1: dashboard menu

In the material feature (Fig. 2), users felt confused upon entering this feature as there was only a button to open the material, leaving them uncertain about which specific material they would be studying.

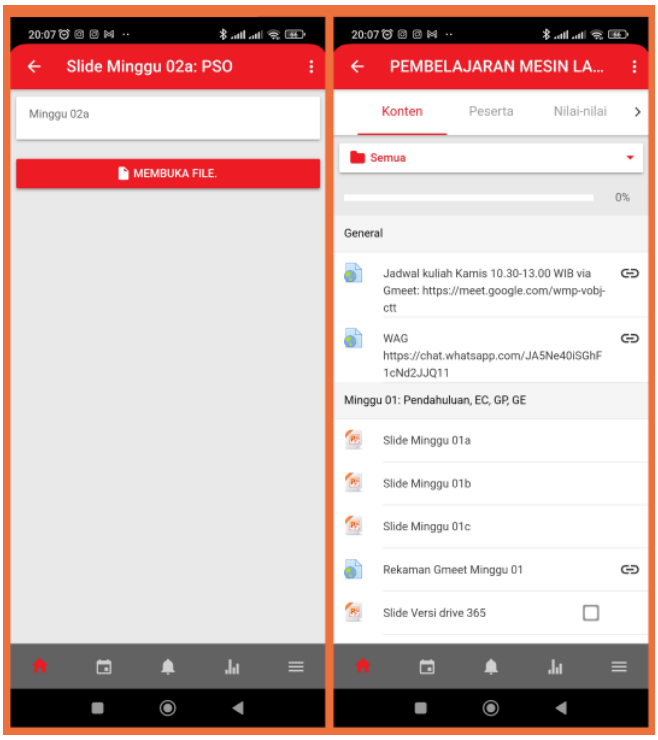

Fig. 2. User interface problem 2: material menu

In *Nilai*/grades menu (Fig. 3) there is a problem where users had to go through three stages to complete a single task just for see the result of quiz or exam.

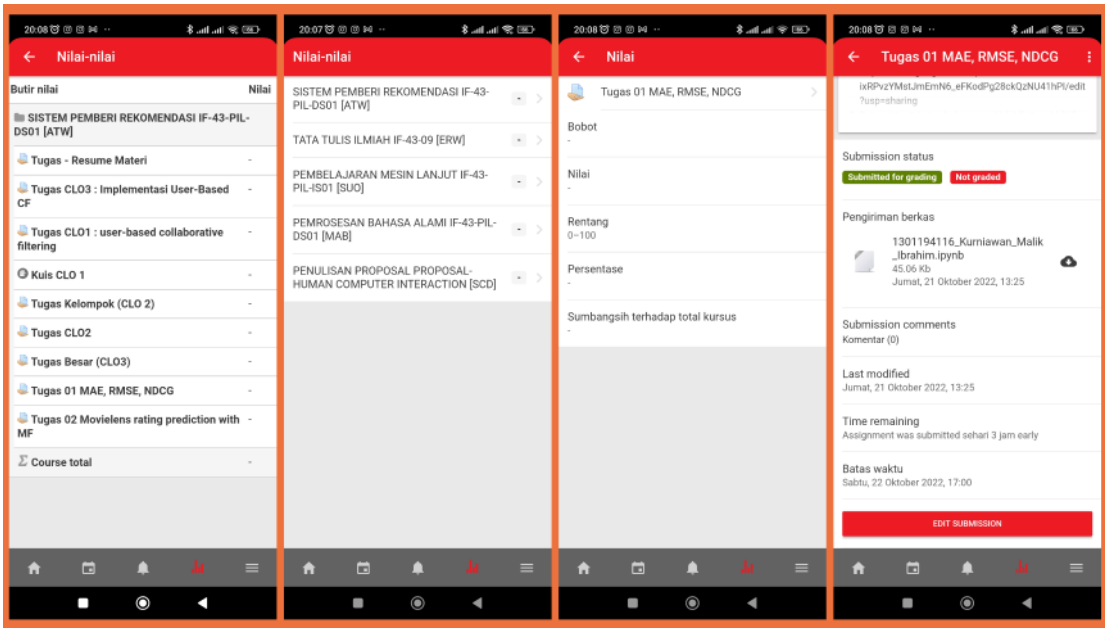

Fig. 3. User interface problem 3: Nilai menu

Furthermore, in *the quiz menu* as seen in Fig 4, students expressed slight annoyance having to click the sidebar button to view the time and the number of questions answered.

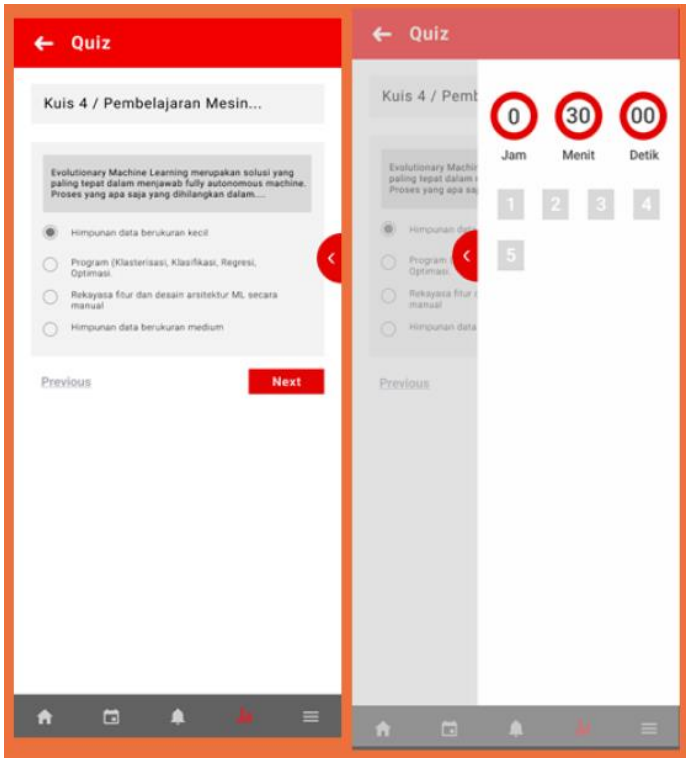

Fig. 4. user interface problem 4 quiz menu

To address these issues, the Learner-Centered Design (LCD) method will be used in the process of redesigning the user interface. LCD is an advancement of the User-Centered Design (UCD) method, LCD aims to assist students in achieving their goals during learning activities. [4]. In addition, LCD can also detect the emotions and needs of students when using online learning platforms, which is very useful in creating an engaging online learning experience [5]. In order to enhance the design results, the learner's personality aspect is considered as an important element in the interface redesign process, aiming to align the final design with the learner's needs and desires. By focusing on personality during the interface design, it is possible to improve user engagement, increase acceptance of the design, and ultimately enhance user satisfaction with the product. The design process specifically focuses on introversion and extroversion as they represent distinct ways of utilizing an interface and processing information. This simplified approach to personality allows designers to gain a better understanding of user behavior and create a user interface design that provides an even more immersive user experience. This will result in two different interface designs: one for introverted students and one for extroverted students. This is done because personality factors influence user interface design preferences. Redesigning the user interface of the LMS Tel-U mobile application using the LCD method and a personality approach is interesting because previous research [6], [7] has shown that the use of LCD and personality approach in an e-learning platform can influence the learning experience of users. It is expected that this redesign will improve the usability of the LMS Tel-U mobile application.

This research aims to apply the Learner-Centered Design method and personality approach to redesign the interface of the LMS Tel-U mobile application according to students' needs and analyze the usability redesign results to determine if the SUS score has reached 68.2 using the System Usability Scale (SUS) because the level of good usability for websites or applications (SUS score = 68.2) [2]. This paper is divided into six sections: Introduction, Litrature Review, Method, Results, Discussion, Conclusion, Appendix, and References.

II. LITERATURE REVIEW

At this stage, a literature review is also conducted on user interface, Learner-Centered Design, e-learning, and user experience, as well as several related studies, to serve as references or to strengthen the research.

In a study conducted by Subaramaniam, et al [6], in their research about relationship personality types and interface design in e-learning systems to create an effective e-learning experience it was shown that there is a correlation between interface design and human personality in e-learning applications, particularly with MBTI personality types, which can enhance students' learning productivity and interest in higher education. In research about Effective Learner-Centered approach used in the digital systems course, Debiec [7] found that after implementing Learner-Centered approach in the course, the average final scores of the students increased by more than 30%. In a study about the comparison between the System Usability Scale and Heuristic Evaluation, Ependi, et al [3] shown that the System Usability Scale is better than Heuristic Evaluation because it only requires a number of respondents to determine whether an application can be considered usable or not, while still maintaining good validity. In a research conducted by Pratiwi, et al [5], about Identifying Learning Experiences with e-learning Using User Persona Techniques based on the Learner-Centered Design concept reported that user personas can obtain more detailed data regarding learners' needs in e-learning according to their desires and expectations. This enables the design to be more effective and aligned with learners' desires and expectations for e-learning. In a research about an Interactive Adaptive Learning System based on Agile Learner Centered Design by Battou, et al [8] it was shown that learners are an integral component in the system development, where they can make changes to the system. Thus, learners are considered as partners who actively participate in improving the system. This leads to the creation of learner motivation to deliver better results and enhance the learning process. In a research about the impact of mobile learning on students' achievement result, Klimova [9] reported that mobile e-learning, designed based on students' needs and continuously facilitated by teachers, is effective in enhancing students' learning abilities and contributes to positive learning outcomes. Furthermore, mobile learning also serves as an appropriate supplementary method in the learning process and provides quick feedback during the learning process.

III. RESEARCH METHOD

A. Research Stages

The Figure 5 explains the steps in the research used to redesign the application. Below is the flow of research stages used in completing this research.

Fig. 5 Research Stages

B. Literatur Review

At this stage, a literature review related to the user interface, Learner-Centered Design, e-learning, and user experience was also carried out, as well as some related research to become reference material or reinforcement in this study.

C. Data Collection

At this stage, data were collected on users of the mobile LMS Tel-U application by conducting interviews with 12 Telkom University students which aimed to know in more detail the problems of students when using it, understand the expectations and needs of students after the redesigning the application and getting suggestions from learners about how the interface design they expect in the future. At this stage, a usability evaluation was also carried out using SUS which contained 10 questions raised by J Brook [10]. The following are SUS questions in Indonesian [11], which can be seen in Appendix.

There are several rules for calculating SUS values, namely [12]:

1. The scale strongly disagrees is worth 1 and the scale strongly agrees is worth 5.

2. Odd statement: minus 1 from the answer given by the user.

3. Even statement: 5 is subtracted from the answer given by the user.

4. Add up the converted answers and then multiply the number by 2.5.

Furthermore, the researcher distributed the SUS questionnaire to the respondents who had been determined through the Google form media. Respondents answered questions on the SUS questionnaire, with a score of 1 for the Strongly Disagree scale to a score of 5 for the Strongly Agree scale. The average SUS score was 43.5, Based on the categorization in SUS, the results are Grade Scale in "F", Adjective Rating in "Ok", and Acceptability Range in "Not Acceptable".

D. Redesign Application

The next step is to redesign the LMS Tel-U mobile application interface. At this stage, the author uses the Learner-Centered Design (LCD) method approach. LCD is a further development of the UCD method, , but has a difference in the goals to be achieved, in the design process, LCD aims to assist students in achieving their goals when learning activities [4]. Blumenfeld et al [13] stated that Learner-centered makes student interest higher by providing a broader view of subject matter, activities adapted to different types of learners, opportunities to interact with other students, and playing a more active role in the learning process. Zaharias et al [14] stated that LCD has five focus points namely: enabling students to find something for themselves, having clear learning objectives, using informative feedback, designing to get students' attention, using visual elements to enhance meaning, and facilitating social learning. There are 4 parts on the LCD, namely:

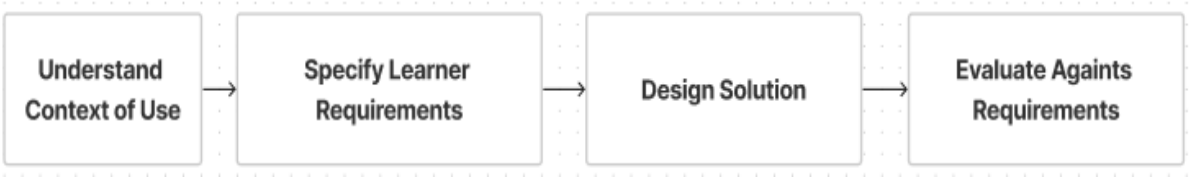

Fig. 6 The LCD Stages

Learner-Centered Design has the same flow as User-Centered Design. However, there are fundamental differences in terms of aims, focus, characteristics, domain knowledge, targets and approaches [4], here is an explanation of the LCD stages [15] :

a. Understand the Context of Use. At this stage identification of users like what will use the system. Describe what product will be made and under what conditions this product will be used.
b. Specify Learner Requirements. At this stage the identification of user needs aims to match the product to user needs, one of which is by interviewing.
c. Design Solutions. At this stage the design, starting from rough sketches to prototypes, begins to be made in stages.
d. Evaluate Against Requirements. At this stage, an evaluation of the design that has been made is carried out whether the goals and needs of prospective users when using the product have been achieved.

E. Testing

At this section, application testing is carried out. The purpose of this test is to measure usability and evaluate new designs that have been made of the LMS Tel-U mobile application.. For testing, SUS was used which contained 10 questions according to those in Table 1.

IV. RESULTS AND DISCUSSION

A. Understand Context of Use

After obtaining sufficient data from the interview stage of respondents who came from Telkom University students, the authors conducted data analysis to form a persona. A persona is an imaginary figure assembled from research to describe the many characters of users who maybe use the same product, service, brand, or site. Persona is a depiction of a user who can explain the problems encountered in product design [16]. Persona creation can support understanding user requirements, experiences, behaviors, and goals. Creating personas can help in identifying the needs and expectations of different users for the designs to be made. Personas make the design task less complicated and can help in achieving the goal of creating a good user experience [17].

TABLE II
USER PERSONA

Personality	**Demographic**	**Goals**	**Pain Points**	**Motivation**	**Needs**
Introverts	Age : 21-23 Years Old. Gender : Male and Female. Occupation : Telkom University Students. MBTI Personalities : INFP, INFJ, ISFJ, INTJ	Get easy access to materials, quizzes, and lecture information so you can study in the desired place and conditions. View the results of assignments/quizzes in a more organized and easy way It's easy to see task/quiz reminders, and you can set the reminder deadline for a longer period so you can better prepare for assignments/quizzes	The application response is sometimes slow and has a complicated appearance. The application server is sometimes down. Some features/materials cannot be accessed freely. The User Interface is not well understood when it is the first time using this application.	Can easily access learning materials and materials without having to use a laptop and access the website first. Can do quizzes or access learning material easily Getting complete learning material is not only by downloading the material slides, but there is a brief introduction of the material so that students know what they are going to learn, and there are learning videos as supporting materials for the material.	An application that has a simple interface and is easy to use, especially for new users. Explanation of material that is complete and clear, not just downloading lecture material slides. A detailed explanation of the material. All features can be accessed easily.

B. User Persona

In this section, the author conducts interviews to analyze and obtain the data needed to create user personas and needs. The number of respondents used in this interview were 12 respondents using the mobile application LMS Tel-U. Because according to Jakob Nielsen [18], the target user involved in a study is a minimum of 5 people to get test results of more than 75%. To conduct this research, the target user is 12 people because it is enough to get test results of more than 75%. Items in persona can be in the form of demographics, needs, concerns (pan points), goals, and motivations [19]. The persona created is divided into two, namely, the introverted student persona and the extroverted student persona. The user persona can be seen in Table II.

C. Specify Learner Requirements

At the specific user requirements stage, identification of the needs of the user is carried out. This identification includes user persona analysis (goals & requirements), mental model, and hierarchical task analysis (HTA).

D. User Persona Analysist

At this section, the author conducts an analysis of user needs from the outcome of user personas that were made before. This section's function is to understand the user needs when using LMS Tel-U mobile application. The result of user persona can be seen in Tabel III.

E. Model Mental

Model Mental are the thoughts of a user on how a system or a product works [20]. In this context is how extroverted and introverted students think when using the LMS Tel-U mobile application. The mental model serves to understand the mindset of a user towards the process of completing a system. for mental models can be seen in appendix.

F. Hierarchial Task Analysis (HTA)

Hierarchical Task Analysis (HTA) functions to break down existing tasks into several subtasks or actions. The components of the task are then represented in a chart. HTA can be used by designers to describe goals/objectives, tasks, subtasks, and plans that are important to user activities. Here is the HTA that has been created. for mental models can be seen in appendix.

G. Design Solution

At the Design Solution stage, user interface design is carried out based on user experience, analysis of needs, and problems from users when using applications that are already known in the previous stage. The first stage is to create a low-fidelity design in the form of a wireframe, then proceed to create a high-fidelity design in the form of making a mockup, and then proceed to the final form in the form of a prototype.

H. Wireframe

Tel-U mobile application. Wireframes are simple frameworks in the form of images that serve to describe all interface components and functionalities before entering the mockup stage [21]. Wireframes have an important function, which is to assist in creating layouts and help organize information in the interface design for users [21]. Fig.7 is an example of the wireframe that has been created, the wireframe on the right for extroverted students and the one on the left for introverted students.

TABLE III
USER REQUIREMENT

Personality	Goals	Requirements
Introverts	It's easy to see task/quiz reminders, and you can set the reminder deadline for a longer period of time so you can better prepare for assignments/quizzes.	Relocation and redesign of the reminder section on the dashboard menu with the next deadline options 3 days, 7 days, 14 days, next 1 month, next 2 months, next 4 months.
	Get access to materials, as well as information related to lectures easily so that you can study in the desired place and conditions.	Redesign the material section by including introductory material so you don't get confused about the material to be studied, a summary of the material, learning videos and download material files on the same page.
	View the results of assignments/quizzes in a more organized and easy way.	Relocation and redesign of the dashboard menu to make it more accessible and more informative but with a minimalist appearance.
	Convenience in taking quizzes, such as easily seeing the number of questions answered and the actual processing time, as well as a submit button that can be accessed easily in urgent situations.	Redesigned the nilai-nilai menu to make it more minimalistic, neat with grouping based on courses and easy to use. Redesigned the time and number of questions so that they are immediately visible and added a separate submit button to the quiz menu.
	It's easy to view existing announcements and view on going courses.	Redesigned the dashboard menu with a newer and more informative appearance
Ekstrovert	Easily see the results of assignments / quizzes by sorting from the most recent assignment.	Redesign the nilai-nilai menu to make it more minimalist, neat and easy to use with the last assignment/quiz grouping done.
	Easily visible assignment/quiz reminders and fewer timer options with shorter timeframes.	Relocation and redesign in the reminder section on the dashboard menu with the next deadline options 7 days, 14 days, next 1 month, next 4 months.
	It's easy and comfortable when doing quizzes.	Redesigned the time and amount sections on the quiz questions page so that they are easy to see when working on questions.
	Easy to get lecture materials and lecture support materials.	Redesign the material section by including a summary of the material so you can see the big picture of the material to be studied, learning videos and download material files on the same page.
	It's easy to find materials/assignments, and it's easy to see existing announcements and see the progress of ongoing courses.	Relocation and redesign of the dashboard menu so that it is easy to access information related to lectures, announcements from the CeLOE admin, and other things related to lectures with a more minimalist design and easy to use.

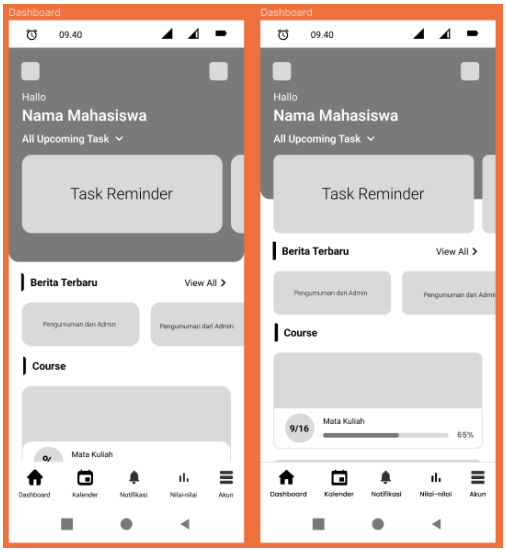

Fig. 7 Wireframe after redesign

I. Mockup

At this stage a final design is made based on the wireframe design that has been made, mockups are made with colors, icons, and also fonts but the designs made do not look interactive (Fig.8). The mockup provides a detailed overview of the design before proceeding to the prototype stage. The mockup was designed using the Figma application. Design for extroverts has more pronounced differences between interactive elements and uses brighter colors such as yellow, blue, and red. The background is changed from blue-green to red-orange, and the windows have thicker outlines and sharper shapes. On the other hand, design for introverts has more subtle differences between interactive elements and uses darker colors like green, white, and gray. The background is white-green with rounder and thinner frames, and it guides the user downwards through the use of fewer and smoother visual buttons. [22]

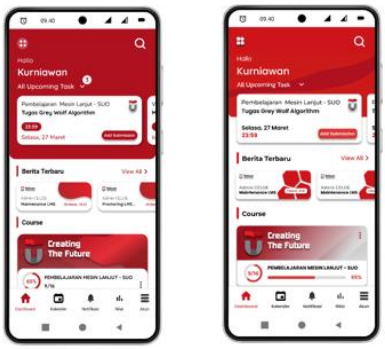

Fig. 8 Mockup Design after redesign

This page is the dashboard page which is the first page when entering the application. this section contains search buttons, task reminders which can also set time settings for task reminders, announcements from the LMS admin in the latest news section, and the courses students take part in this section also show the progress

of the courses students take. The left is for introverted students and the right is for extroverted students. Next is the course page, this page contains announcements from lecturers, assignments/quizzes, and learning materials.

The course page is a continuation when the user presses the course section on the dashboard. This page contains announcements from lecturers, assignments/quizzes, and learning materials. This learning material page contains a summary of material for extrovert students and introductory material for introverted students. As explained by Kim, introverted and extroverted students have different approaches to studying learning materials. Introverted students tend to prefer learning from basic principles and then progressing to more complex stages, while extroverted students prefer starting with a general overview of what will be studied and gradually delving into deeper details [23]

In the nilai-nilai menu, there are changes in the form of values that can be immediately seen in the name of the assignment/quiz that has been done. In addition, there are differences between designs for introverted and extroverted students, for introverted students the results of their quiz work/assignments will be grouped first based on the course, while for extrovert students it can be seen directly based on the latest assignment/quiz that has been done.

In general, designs for introverted students are characterized by having colors with low contrast, icons and fonts that have rounded corners, corners that are more rounded and the design seems simpler. Meanwhile, extrovert students have characteristics in the form of colors with higher contrast, icons and fonts with sharper/firmer angles, sharper corner and a more lively design.
For a complete view of wireframes and mockups can be seen in appendix.

J. Prototype

At this stage, a prototype of the LMS Tel-U mobile application was made based on the results of mockups that have been made before to make it look interactive. The prototype serves to simulate how users use the new interface on the LMS Tel-U mobile application.

K. Evaluation

After the prototype has been made, then an evaluation is carried out which is the final stage of the research. The evaluation was carried out by testing the new interface design in the model of a working prototype of the LMS Tel-U mobile application on 12 respondents using the SUS questionnaire This evaluation serves to determine whether a new interface design has been created can be accepted or used according to the needs and expectations of users and also to determine the impact of using the LCD in increasing the usability value of the LMS Tel-U mobile application.

L. Testing

At this section, a test was carried out on the a new design has been made to measure the usability level of the new interface design for LMS Tel-U mobile application. Tests were carried out on the same 12 respondents at the beginning of the study at the initial testing and interview stages. This aims to maintain consistency in research. In addition, it is intended that respondents feel the difference between the old interface with the new interface that has been created. For testing the researcher uses a Figma prototype which can be accessed on each respondent's device. After the respondent finished seeing and running the intended prototype, the researcher gave the SUS questionnaire using the Google form media which contains 10 questions, with answers in the form of a score with a range of 1-5, score 1 for the answer "Strongly Disagree" and score 5 for the answer "Strongly Agree". This assessment is based on the SUS assessment standard [14].

M. Analysist The Testing Result

In this section, it was carried out by comparing the outcome of the SUS score obtained when the interface display had not been redesigned with the final SUS score results after the interface redesign was carried out using the LCD method and the personality approach. The following are the results of the SUS calculations that have been given to respondents and the comparison of the old interface design SUS with the new interface design SUS scores. After processing the SUS value, a score of 80.4. Based on the categorization in SUS, the

results of the interface redesign that have been made have increased compared to the old interface design, namely, on the Grade Scale from "F" to "B", Adjective Rating from "Ok" to "To Excelent", Acceptability Range from "Not Acceptable" to 'Acceptable'. It can be seen from Fig.9 that show the usability value of the LMS Tel-U mobile application has increased from initially only getting a value on SUS of 43.5 before implementing the LCD method and personality approach to 80.4 after applying the LCD method and personality approach.

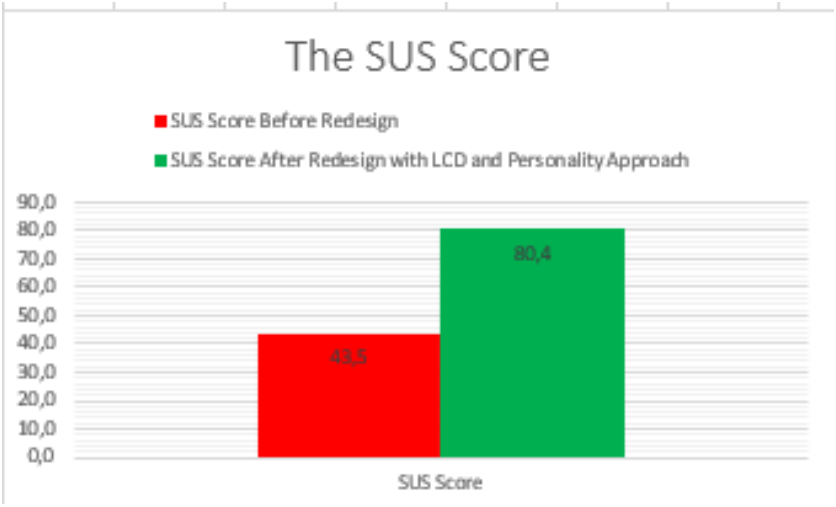

Fig. 9 The Comparison of SUS Score

It can also be seen that before incorporating personality elements into an interface design, this application only obtained a SUS score of 44 for introverted students and 43.2 for extrovert students. However, after incorporating personality elements into the results of the interface redesign, an increase in the SUS score was obtained from the original 44 for introverted students to 81 and for extrovert students from the original 43.2 to 80 (Fig. 10).

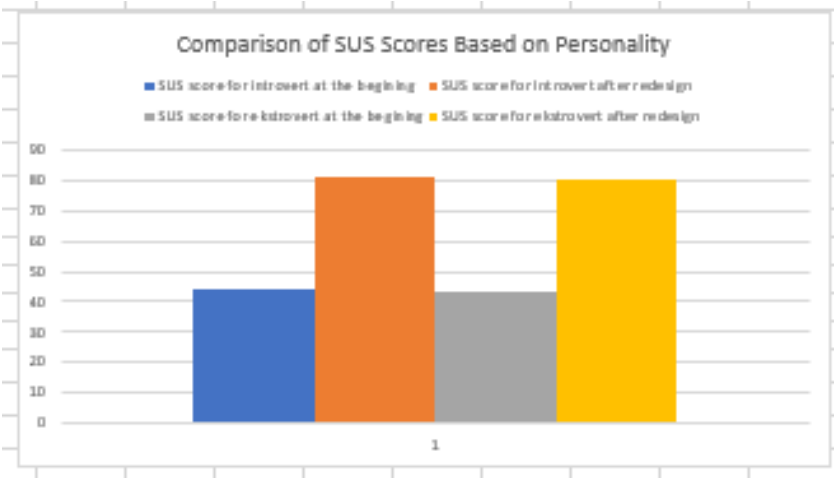

Fig. 10 Comparison of SUS Score based on personality

After testing usability using SUS for this application it was also proven that from the same 12 respondents in the beginning, all experienced a significant increase in SUS scores

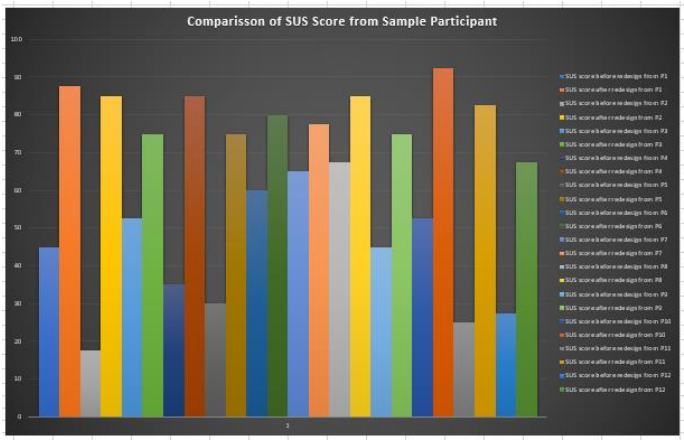

Fig 11 Detail of SUS Score from Participants

Fig. 11 show that after using the LCD method and personality approach on the interface the LMS Tel-U mobile is acceptable and in accordance with the learner wants and needs for an e-learning. It also has increased its usability level compared to before using the LCD method and personality approach on the interface.

V. CONCLUSION

Based on the outcomes of research and testing that have been completed, users of the LMS Tel-U mobile application have several needs, namely, users want to more easily see reminders of assignments/quizzes, get complete and easy access to material, get information or announcements about lectures easily, work easily. quizzes, and it's easy to see the results of assignments or quizzes. Based on that, the author redesigned the interface with two different design styles: one for introvert interface design and another for extrovert interface design. After that, a dashboard redesign was carried out by changing the layout, colors, and fonts to ensure that relevant information about lectures, such as reminders about assignments/quizzes, announcements from the LMS admin, and course progress, can be easily conveyed to students. Then, for the course section (materials), interface redesign was also conducted, including changes in layout, colors, and fonts to enable students to easily access assignments/quizzes and course materials. The course materials underwent significant changes by transforming them into a single page that includes a summary of the material (for extroverts), introductory material (for introverts), supporting learning videos, and a download button for the materials, all on one page. This allows students to have easier access to learning materials. For the quiz section, there are changes in the font and color, the addition of instructions for introverted student designs, as well as the addition of information on the number of questions answered, a finish button, and the remaining time displayed on the main page. Then, to make the grades menu easier to access, unnecessary steps were reduced, and for the extrovert interface, the layout was changed based on the last task submitted without grouping them by courses first. Meanwhile, for the introvert interface, it was designed based on grouping the courses first. Therefore, This study has shown that the Learner-Centered Design (LCD) method and the personality approach can effectively improve the usability of distance learning (e-learning) applications. Based on the obtained results, which showed an increase in the average usability score of the mobile LMS Tel-U application from 43.5 to 80.4, this research findings can be utilized by the university for improving the interface of the mobile LMS Tel-U application in the future. The implementation of Learner Centered Design and the personality approach can greatly contribute to the development of this application, making it easier for students to use the mobile LMS Tel-U application as a supportive tool in their learning process. Further research may be explored the interface of features or other menus such as calendar, search, notifications, and accounts to enhance the interface quality and achieve better user usability scores in the future. Additionally, it would be interesting to redesign without using the personality approach to determine whether better or worse results can be obtained compared to the design results using the personality approach.

VI. APPENDIX

All material in this study can be found at :

https://bit.ly/3WnNdt1

I. REFERENCES

[1] K. B. Lee and R. Salman, "The Design and Development of Mobile Collaborative Learning Application Using Android," 2012. [Online]. Available: www.jitae.org

[2] A. Bangor, P. Kortum, and J. Miller, "Determining What Individual SUS Scores Mean: Adding an Adjective Rating Scale," *J. Usability Studies*, vol. 4, no. 3, pp. 114–123, May 2009.

[3] U. Ependi, T. B. Kurniawan, and F. Panjaitan, "System Usability Scale Vs Heuristic Evaluation: A Review," *Jurnal SIMETRIS*, vol. 10, no. 1, 2019.

[4] D. Dhar and P. Yammiyavar, "Design approach for E-learning systems: Should it be user centered or learner centered," in *Proceedings - 2012 IEEE 4th International Conference on Technology for Education, T4E 2012*, 2012, pp. 239–240. doi: 10.1109/T4E.2012.57.

[5] P. Y. Pratiwi and I. G. Sudirtha, "SISTEMASI: Jurnal Sistem Informasi Identification of Learning Experience in Online Learning with User Persona Techniques Based on Learner-Centered Design Concepts." [Online]. Available: http://sistemasi.ftik.unisi.ac.id

[6] K. Subaramaniam, J. L. Ern-Rong, and S. Palaniappan, "Interface designs with personality types: An effective E-learning experience," *Evergreen*, vol. 8, no. 3, pp. 618–627, Sep. 2021, doi: 10.5109/4491654.

[7] P. Debiec, "Effective Learner-Centered Approach for Teaching an Introductory Digital Systems Course," *IEEE Transactions on Education*, vol. 61, no. 1, pp. 38–45, Feb. 2018, doi: 10.1109/TE.2017.2729498.

[8] A. Battou, O. Baz, and D. Mammass, "An Interactive Adaptive Learning System Based on Agile Learner-Centered Design," *EAI Endorsed Transactions on Smart Cities*, vol. 2, no. 7, p. 154106, Feb. 2018, doi: 10.4108/eai.12-2-2018.154106.

[9] B. Klimova, "Impact of mobile learning on students' achievement results," *Educ Sci (Basel)*, vol. 9, no. 2, Jun. 2019, doi: 10.3390/educsci9020090.

[10] J. Brooke, "SUS: a retrospective," *J Usability Stud*, vol. 8, pp. 29–40, Jan. 2013.

[11] P. Insap Santosa and dan Wing Wahyu Winarno, *Evaluasi Usability pada Sistem Informasi Pasar Kerja… Evaluasi Usability Pada Sistem Informasi Pasar Kerja Menggunakan System Usablity Scale*.

[12] A. Wibowo Soejono, A. Setyanto, and A. Fatah Sofyan, "Evaluasi Usability Website UNRIYO Menggunakan System Usability Scale (Studi Kasus: Website UNRIYO)", [Online]. Available: www.respati.ac.id

[13] J. Choi, J. H. Lee, and B. Kim, "How does learner-centered education affect teacher self-efficacy?The case of project-based learning in Korea," *Teach Teach Educ*, vol. 85, pp. 45–57, Oct. 2019, doi: 10.1016/j.tate.2019.05.005.

[14] ELM Learning, "What is Learner Centered Design ?," Aug. 02, 2022. https://elmlearning.com/blog/learner-centered-

design/#:~:text=Learner%2Dcentered%20design%20focuses%20on,the%20materials%20around%20their%20experience. (accessed Oct. 29, 2022).

[15] L. Fanani, M. Tri Ananta, and K. C. Brata, "Penerapan User-Centered Design dalam Pengembangan Aplikasi Pencarian Gedung Berbasis Android," *CYBERNETICS*, vol. 2, no. 02, pp. 225–233, 2018.

[16] M. Pröbster, J. Hermann, and N. Marsden, "Personas and Persons - An Empirical Study on Stereotyping of Personas," in *Proceedings of Mensch Und Computer 2019*, in MuC'19. New York, NY, USA: Association for Computing Machinery, 2019, pp. 137–145. doi: 10.1145/3340764.3340771.

[17] F. R. Dam and T. Y. Siang, "Personas – A Simple Introduction," Jan. 2022. https://www.interaction-design.org/literature/article/personas-why-and-how-you-should-use-them (accessed Oct. 26, 2022).

[18] B. R. Momintan, E. Darwiyanto, and J. H. Husen, "Pemodelan User Interface Aplikasi Pengenalan Rambu Lalu Lintas dengan Augmented Reality berdasarkan User Experience untuk Anak Usia Dini."

[19] *53rd Hawaii International Conference on System Sciences (HICCS), online, January 5-8, 2021*. University of Hawai'i at Manoa, 2021.

[20] R. Hartson and P. Pyla, "Mental models and conceptual design," *The UX Book; Elsevier: Cambridge, UK*, pp. 327–340, 2019.

[21] S. Morson, *Learn design for iOS development*. Apress, 2014.

[22] T. Alves, J. Natálio, J. Henriques-Calado, and S. Gama, "Incorporating personality in user interface design: A review," *Personality and Individual Differences*, vol. 155. Elsevier Ltd, Mar. 01, 2020. doi: 10.1016/j.paid.2019.109709.

[23] J. Kim, A. Lee, and H. Ryu, "Personality and its effects on learning performance: Design guidelines for an adaptive e-learning system based on a user model," *Int J Ind Ergon*, vol. 43, no. 5, pp. 450–461, 2013, doi: 10.1016/j.ergon.2013.03.001.