



UI/UX Design and Evaluation: Web Platform to Support Self-Regulated Learning with a User-Centered Design Approach

Azhar Nurulhaifa, Rizki Hikmawan*

Information Systems and Technology Education Study Program,
Universitas Pendidikan Indonesia.

*Corresponding Author. Email: hikmariz@upi.edu

Abstract: This study aims to develop and evaluate a UI/UX design that supports the three phases of Self-Regulated Learning (SRL)—forethought, performance, and self-reflection—and to assess user satisfaction, usability, and feature suitability. The research employed a User-Centered Design (UCD) approach, involving two rounds of usability testing with ten participants. Data were collected using the Cognitive Walkthrough (CW), System Usability Scale (SUS), User Experience Questionnaire–Short (UEQ-Short), and semi-structured interviews to gather user feedback and suggestions for improvement. The collected data were analyzed using descriptive quantitative techniques. The results demonstrate consistent improvements across testing phases, with the SUS score increasing from 77.5 to 88, indicating an “excellent” level of usability. In addition, the final UEQ-Short overall score reached 2.575, which falls within the “excellent” acceptance category. This study addresses the limited availability of direct feedback during the self-reflection phase of SRL by integrating an AI-based chatbot as an adaptive reflection partner. The chatbot provides real-time metacognitive feedback, thereby enhancing learners’ reflective processes and supporting more effective self-regulated learning.

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Introduction

With the rapid advancement of technology and the use of Artificial Intelligence (AI), the world of education faces new challenges in maintaining student motivation. Although various e-learning platforms have been developed, not many explicitly integrate the Self-Regulated Learning (SRL) approach, especially in terms of setting goals and monitoring learning progress in real time. Previous research shows that most SRL applications have not optimally accommodated structured goal setting, lack clarity in their theoretical foundations, and do not provide transparent evaluation instruments. In fact, clear and measurable learning objectives are crucial components in the development of SRL skills (Alvarez et al., 2022; de Ruig et al., 2023; Xu et al., 2023). On the other hand, the process of real-time monitoring and adaptation of learning has also not been effectively accommodated (Wolters, 2021).

The theory of Self-Regulated Learning, as explained by Winne and Perry (2000) and Zimmerman (2008), emphasizes the development of three core processes, namely metacognition, motivation, and strategic action. Zimmerman (2008) reflects this in a three phase cycle: Forethought (goal setting, motivation assessment, and strategy planning), Performance (strategy implementation, focus of attention, and progress monitoring), and Self-Reflection (evaluation of results and adaptation of future learning plans) (Brenner, 2022). However, in practice, most digital learning platforms have not been able to realize all three phases simultaneously. The Self-Reflection phase in this theory poses a major challenge

because students need immediate feedback to evaluate their learning outcomes and obtain an overview of their next learning plan, while such mechanisms are still rarely provided. Therefore, this study focuses on the Self-Reflection phase by utilizing AI Chatbot technology as metacognitive scaffolding to provide quick and adaptive feedback to support students' learning reflection process (Chang, 2023).

This study aims to design an SRL-based e-learning UI (User Interface) that holistically integrates the Forethought, Performance, and Self-Reflection phases with the help of an AI Chatbot as an adaptive reflection partner. To achieve this goal, this study adopts a User-Centered Design (UCD) approach to ensure that the designed system can meet user needs. This approach was chosen because of its iterative design process, which allows for design refinement based on input from various users and supports the development of more adaptive solutions (Fleury, 2024).

By targeting the need for real-time metacognitive and motivational feedback, this study presents a novelty in the form of a scalable and adaptive SRL-based e-learning UI prototype design. The integration of AI Chatbot is not positioned as a general tool, but as an adaptive reflection partner that plays a direct role in supporting the Self-Reflection phase through real-time feedback. This research contributes to efforts to improve the concept of metacognitive reflection in SRL theory into UI/UX designs that can be applied and developed in digital learning systems on an ongoing basis.

Research Method

The method used in this study is User-Centered Design (UCD). The User-Centered Design method combines research on who the target users are using User Research (UR) with research on studying the patterns of interaction between applications and users using User Experience (UX) (Duvaud, 2021). User Experience plays an important role in how users assess User Satisfaction, as well as determining how successful a system is in the field of information technology (Yoon, 2022). Although the methods and models in User-Centered Design focus on the individual perspective, the main challenge lies in how the design remains adaptive to the diversity of other users' behaviors in the system (Fleury, 2024).

This method will go through 5 stages, namely Preliminary Study, Usability Evaluations1 (UE1), Redesign UI/UX, Usability Evaluations2 (UE2), and Closing (A'ang, 2022). The system or application being tested is called Regulo, a mobile application that offers a new system to support independent learning using the concept of Self-Regulated Learning, assisted by an AI Chatbot to provide real-time feedback to users. This testing was conducted in 2 stages, with each stage tested by 5 respondents who were students.

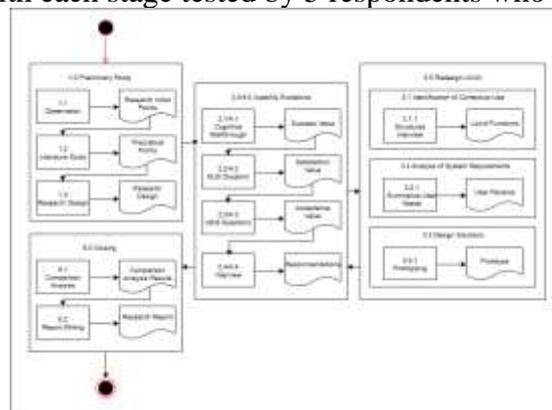


Figure 1. Research Procedure

Preliminary Study

This stage includes observation and literature study to analyze user needs, which will later become input points for features in the application. Observations were conducted through interviews with several respondents about their learning habits, complaints about the learning process, and suggestions for the application to be developed. Through interviews, researchers were able to identify problems and find shortcomings in the user experience (Septiadi et al., 2025). Literature studies were conducted to find gaps in previous research, so that new innovations or solutions to existing shortcomings could be produced and incorporated into this study.



Figure 2. Research design (a) Materi Belajar (Learning Materials) Page; (b) Homepage

The results of observations from two respondents produced two suggestions: adding links to learning resources that can be accessed independently and providing a notification feature to remind users to study. In the literature study, the researchers found that there has been no research that provides real-time feedback to support a more efficient and faster Self-Regulated Learning system. The proposed innovation is to utilize artificial intelligence to provide real-time feedback to users.

Usability Evaluations

The Usability Evaluations stage, as a structured evaluation of the interactive UCD series, is an important part of finding solutions to human problems (Meyer et al., 2021). The design that has been created will be tested in two stages. Prototype testing is measured based on three main instruments and supported by unstructured interviews. These instruments are *Cognitive Walkthrough (CW)*, *System Usability Scale (SUS)*, and *User Experience Questionnaire (UEQ)*. The results of data processing are descriptive quantitative, because they are in the form of numbers.

In the first UE (User Evaluations), respondents tested the prototype from the preliminary study results by conducting a CW, filling out the SUS and UEQ, and conducting interviews to provide input and suggestions. If deficiencies or recommendations were found in UE1, the design would be revised according to the findings. Before proceeding to the UE2 stage, the researchers first created user personas to gain a deeper understanding of the target users. The UE2 stage repeated the same procedure as UE1, and the results of UE2 would be the final assessment of this study.

UI/UX Redesign

The data from UE1 is compiled into a list of user requirements that will be used as a reference for the redesign stage. From this list, user personas are created to describe the profiles of users who are likely to need this application. The initial prototype is adjusted to the list of requirements to produce new solutions/designs, which are then tested again in UE2.



Closing

The final stage is to analyze the results of the UE1 and UE2 data processing and then compare them. This comparison will provide an overview of whether the application's design/system meets user needs and provides improvements after the redesign stage. The testing is considered successful if there is an increase in value from the UE1 to UE2 data.

Instruments

Cognitive Walkthrough

Cognitive walkthrough (CW) is a usability analysis technique in which the interface is assessed through an analysis of the steps required by the user. This approach is effective in quickly finding major usability issues in interface design, as well as identifying obstacles in the use of the application system for new users (Farzandipour et al., 2021). This study uses a commonly used user experience (UX) testing tool, namely Maze. Maze presents test values in the form of success rate, drop-off rate, and misclick rate. These three data points show how new users experience interacting with the interface design. This study provides 10 tasks for testing at the CW stage.

Table 1. List of tasks in the Cognitive Walkthrough

No.	Task
1	Sign Up and Sign In to the application
2	Access to the Learning Materials section
3	Add new learning materials
4	Go to the Learning Target section
5	Add a new learning target
6	Add a new learning resource in the Learning Materials section
7	Selecting learning material categories and uploading files/adding learning material links
8	Study all materials and discuss with the AI Chatbot until completion
9	Using the AI Chatbot (ReguloChat)
10	View the history of learning/discussion results with the AI Chatbot from the last learning session

System Usability Scale (SUS)

The System Usability Scale (SUS) is used to obtain a general overview of how well users experience the new system. SUS contains ten short questions, making it practical to implement. The advantage of using this instrument is that it can produce reliable results even when tested on a small sample (Cheah et al., 2023). The ten statements are divided into two groups, namely odd statements and even statements. Odd statements represent positive statements, while even statements represent negative statements.

Table 2. SUS Questionnaires

No.	Question
1	I feel that I will use this system often
2	I feel this system is too complicated
3	I feel that this system is easy to use
4	I feel I need help from others/technicians to be able to use this system
5	I feel that the features in this system are well integrated
6	I feel there are too many inconsistencies in this system
7	I feel that most people will be able to learn how to use this system quickly
8	I feel that this system is very difficult to use
9	I feel confident using this system
10	I need to learn a lot before I can use this system

All of these statements will then be rated by respondents on a scale of 1-5 for each statement provided. After the SUS data is obtained, each odd statement will be reduced by one and each even statement will be reduced by five. After all data is converted, add up all statement values for each respondent and multiply by 2.5. To determine the final score, add up all the SUS values per respondent and divide by the total number of respondents. The final score is then classified according to the applicable SUS category to determine the level of usefulness.

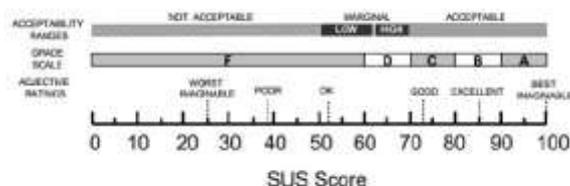


Figure 3. SUS Score

User Experience Questionnaire (UEQ)

In Hajesmaeel-Gohari (2022), Laugwitz et al. introduced the User Experience Questionnaire (UEQ) as a tool for measuring user experience that includes 26 items in six main dimensions, namely attractiveness, perspicuity, dependability, stimulation, and novelty. The assessment uses a 7-point Likert scale. However, this study uses the short type of UEQ to save time in the assessment. The UEQ-Short consists of eight questions from two dimensions, 4 items from the Hedonic Quality Scales (Stimulation and Novelty) and 4 other items from the Pragmatic Quality Scales (Perspicuity, Efficiency, and Dependability) (Schrepp et al., 2023). The Pragmatic aspect focuses on the efficiency and effectiveness of users in completing tasks, while user satisfaction and emotional experience are found in the Hedonic aspect (Saleh et al., 2022).

Table 3. UEQ-Short Questionnaires

No.	Item	Dimension
1	Not motivating/Motivating	Stimulation
2	Creative/Monotonous	
3	Difficult/Enjoyable	Novelty
4	Disorganized/Organized	
5	Unintelligible/Intelligible	Perspicuity
6	Confusing/Clear	
7	Inefficient/Efficient	Efficiency
8	Less useful/Useful	Dependability



Figure 4. UEQ Score

After the data is obtained, the 7-point scale scores are converted to values ranging from -3 to +3. Dimensions with two items will have their dimension values determined per respondent first by adding the scores of the two items and dividing them by 2. To obtain the score per dimension, add all the scores and divide them by the number of respondents. The



lower the value, the greater the disagreement, while a high value indicates a stronger level of agreement with the statement given.

Interview

The interviews were conducted in an unstructured manner to explore additional information in the form of criticism, suggestions, and innovative ideas related to the prototype tested by the respondents. This approach did not use a list of questions but took the form of a flowing conversation so that the respondents were more free to express their opinions. The interview results were then analyzed using thematic analysis, a qualitative analysis approach that focuses on identifying and grouping themes from qualitative data (Braun & Clarke, 2024). These findings were used to explain the problems encountered and support improvements during the prototype redesign stage.

Results and Discussion

This study involved ten respondents aged 18-20 years, consisting of first-semester and third-semester students; 5 respondents (50%) had IT knowledge and the other 5 respondents (50%) had little understanding of IT. The testing was conducted in two stages, with each stage tested by 5 respondents. The instruments tested in the two stages were the same, namely the Cognitive Walkthrough test, SUS, UEQ-Short, and unstructured interviews lasting 20 to 25 minutes. Between the two testing stages, there was a stage of creating user personas (Figure 5) to map the profiles of users who needed this system, then redesigning based on the findings in the UE1 test.

Table 4. UE1

Person	Cognitive Walkthrough											SUS Score	UEQ-Short					
	1	2	3	4	5	6	7	8	9	10	Duration		ST	NO	PE	EF	DE	
1	S	S	S	S	S	S	S	S	S	S	S	3.64 min	80	3	2,5	3	3	3
2	S	S	S	S	S	S	S	S	S	S	S	3.21 min	70	3	2	1,5	2	3
3	S	S	S	S	S	S	S	S	S	S	S	3.59 min	85	3	3	3	3	3
4	S	S	S	S	S	S	S	S	S	S	S	1.92 min	82,5	1,5	1,5	1,5	2	2
5	S	S	S	S	S	S	S	S	S	S	S	7.48 min	70	3	3	3	3	3
Average	100%											3.96 min	77,5	2,7	2,4	2,4	2,6	2,8

In UE1, all respondents successfully completed all CW tests given, but with some misclicks. The average duration of completion for these 5 respondents was around 18.5 minutes with the help of researchers during testing, resulting in a SUS score of 77.5 due to the confusion experienced by respondents when using this system. The scores on the five dimensions of the UEQ-Short were relatively high: 2.7 (Stimulation), 2.4 (Novelty), 2.4 (Perspicuity), 2.6 (Efficiency), and 2.8 (Dependability), indicating that the system was accepted by all respondents.

Table 5. UE1 Respondent Suggestions

No.	Suggestions
1	Icons, button areas, and fonts are enlarged
2	Improve the flow and appearance for adding new learning resources
3	Change the location of the "Log Out" button
4	Add a separator line between the Sign Up/Sign In options
5	Provide automatic practice questions or AI-generated questions after learning

Table 5 contains suggestions obtained from UE1 interviews, with the average complaint being that the icons, buttons, and fonts are too small, making them difficult to find and click. The position of the "Log Out" button was also confusing because it was located at the bottom left, where it is usually found in the profile section.

Table 6. Application Features

Feature	Function
Materi Belajar (Learning Materials)	Adding learning resources independently, either as links or files. When learning from each resource, users are immediately directed to discuss it first with the AI Chatbot. All progress from all learning resources and materials is immediately visible to the user.
Target Belajar (Learning Target)	Set goals to achieve learning objectives, such as determining by what date a particular material must be completed. There are learning status and learning outcomes that will serve as benchmarks for each goal, which can be adjusted both before and after learning.
ReguloChat	An AI Chatbot provided at the beginning of the application interface and displayed during learning mode to provide real-time learning feedback.

Table 6 outlines the features available in the Regulo application. Of the three features, all respondents most liked the material feature, which allows users to enter independent learning materials, learn without distractions, take notes during learning, and discuss directly with the AI Chatbot after studying a learning material.



Figure 5. User Persona



Figure 6. (a) Learning Materials Page; (b) Learning Target Page; (c) ReguloChat Page in Learning Mode

Figure 6 shows the UI/UX design tested on UE1, but the appearance of this first stage design was considered to still have shortcomings that made it difficult for users to use, so a redesign was carried out to improve the previous design and the results will be tested on UE2.

Table 7. UE2

Person	Cognitive Walkthrough										Duration	SUS Score	UEQ-Short				
	1	2	3	4	5	6	7	8	9	10			ST	NO	PE	EF	DE
1	S	S	S	S	S	S	S	S	S	S	3.88 min	95	3	3	3	3	3
2	S	S	S	S	S	S	S	S	S	S	3.2 min	95	3	3	3	3	3
3	S	S	S	S	S	S	S	S	S	S	3.57 min	90	2,5	3	2	2	3
4	S	S	S	S	S	S	S	S	S	S	4.54 min	100	3	3	3	3	3

5	S	S	S	S	S	S	S	S	S	S	3.95 min	60	1	1,5	0,5	2	3
Average											3.82 min	88	2,5	2,7	2,3	2,6	3

Not many suggestions were given during UE2, and all respondents felt that all the existing features were sufficient and that they were not bothered by the design of the Regulo application UI/UX.



Figure 7. (a) Learning Materials Page; (b) Learning Target Page; (c) ReguloChat Page

Figure 7 shows the results of the UI/UX redesign based on the findings from UE1. Not many aspects have changed, only those items that were recommended to be changed and adjusted to other needs.

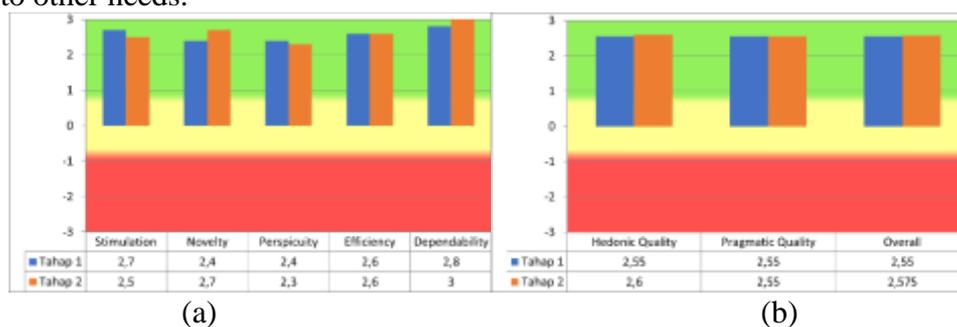


Figure 8. Satisfaction Rate

(a) Acceptance Score (UEQ-Short); (b) Hedonic Quality, Pragmatic Quality, and Overall Scores

Figure 8(b) shows a comparison between the acceptance scores in UE1 and UE2, with increases and decreases in several dimensions, but not too drastic. In terms of Pragmatic Quality (Perspicuity, Efficiency, and Dependability), there was an increase from a score of 2.55 to 2.6, while the Hedonic Quality score (Stimulation and Novelty) remained the same at 2.55. Overall, there was a slight increase from 2.55 to 2.575.

Based on the UE2 results, Pragmatic Quality had an average of 2.55 and Hedonic Quality had an average of 2.6, resulting in an overall average of 2.575. All of these results fall into the "Excellent" category and are within the top 10% of results, indicating that the system provides effective functionality and a good user experience. These findings indicate that the tested User Interface and features not only meet the functional needs of users but also successfully deliver aesthetic value and emotional satisfaction, showing that the current design is suitable as a basis for wider implementation and further studies that will use UCD as the design method.

The features presented also received positive responses from users, who realized that this application would help in a more efficient learning process, because all aspects of online learning that are now often needed by students are available in one application, so users no longer need to open various applications to study. The presence of ReguloChat as an AI Chatbot was welcomed as a discussion medium for users after studying the material, proving



that the aspect of real-time feedback has been realized in the application and is indeed needed by users.

The application of User-Centered Design (UCD) in designing the UI/UX of applications that support Self-Regulated Learning (SRL) has resulted in satisfactory testing and a simple design that meets user needs. UCD has also been proven effective for other learning method platforms, increasing user acceptance and satisfaction. For example, Priyantini et al.'s (2023) research on the Game-Based Learning platform "Ezedu" showed good results, with an easy-to-understand UI flow and a simple yet functional design (Priyantini et al., 2023). This shows that the UCD method can be applied to various learning methods because it has consistently produced platform designs that are easy to understand and suit user needs, as well as achieving a fairly high level of acceptance and satisfaction as proof of the feasibility and quality of the resulting design. The UCD approach was also applied to the design and evaluation of AI-based learning, namely "SEKAPAI," which achieved a SUS score of 86 (category "Excellent") and UEQ ratings of "Good" and "Excellent." These results indicate positive acceptance by users after the redesign, as the system is considered easy to understand, efficient, and reliable (Hikmawan et al., 2025). These findings are in line with research by Huang (2022), which shows that the use of AI chatbots in learning can facilitate more open interactions, such as expressions of agreement and self-disclosure among learners, thereby increasing user comfort and engagement.

However, digital learning platforms explicitly designed to support the SRL method are still limited. The results of this study show that Regulo is designed to fill this gap by presenting an e-learning platform UI/UX design that specifically integrates all phases of SRL simultaneously and AI Chatbot support in the Self-Reflection phase, which, based on user evaluation, has a good level of acceptance and has the potential to support a more structured implementation of SRL.

Conclusion

The UI/UX design of the Regulo platform using the User-Centered Design (UCD) method has been successfully designed, providing satisfactory test results and being well received by users. The three features presented are able to address the needs of the three phases of Self-Regulated Learning (SRL). The forethought phase is represented by the learning target feature, which includes learning planning that covers goal setting, motivation assessment, and strategy planning. The performance phase is represented by the learning material feature, which contains aspects of strategy implementation where users can organize the material they want to learn, focus their attention with a learning mode that reduces user distractions during learning, and monitor progress with a progress bar to track learning progress. Finally, the self-reflection phase, which is the main focus of this study, makes AI a solution for fast and efficient evaluation of results by providing real-time feedback to users. UCD has provided evaluation results that show an increase in the level of satisfaction on the SUS from a score of 77.5 to 88. The acceptance level of Regulo is also in the "Excellent" category on the Pragmatic Quality and Hedonic Quality scales and overall from the UEQ-Short assessment on UE 2 with an average score of 2.575. However, this study still has limitations that need to be considered, such as the limited sample size, controlled system testing, and short testing duration, as well as the fact that it has not been tested on a large scale, so performance and integration risks still need to be further tested.



Recommendation

- A) Platform Development and Accessibility
 - 1) The development of a web-based platform is expected to support the implementation of Regulo in a broader and more sustainable learning context.
- B) Strengthening Self-Regulated Learning Features
 - 1) Development of learning target-setting features based on SMART goals (Specific, Measurable, Achievable, Relevant, Time-bound) to support the Forethought phase.
 - 2) Provision of a learning analytics dashboard that displays learning progress, reflection activities, and goal achievement to support the Performance and Self-Reflection phases.
- C) Development of AI Chatbot and System Evaluation
 - 1) Optimization of ReguloChat (AI Chatbot) so that it can be used repeatedly during the learning process with contextual memory support, so that the feedback provided is adaptive and continuous.
 - 2) Conducting further usability testing involving more users and using standard evaluation instruments such as the System Usability Scale (SUS) and the full version of the User Experience Questionnaire (UEQ).

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