



Designing UI/UX for Web-Based Evaluation in Artificial Intelligence E-Learning to Determine Learning Motivation with Design Thinking Approach

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ABSTRACT

E-learning is a solution to increase knowledge and skills. One of them is for learning artificial intelligence (AI). Based on this, AI can be learned through web-based e-learning, which uses the eCraft2Learn web. The eCraft2Learn website is an e-learning about AI that applies block-based programming to its learning. However, the evaluation feature has not been facilitated on the web. In the educational process, learning evaluation is a factor that needs to be considered to determine the extent to which students master learning and diagnose student learning difficulties. Based on field studies conducted on students at SMK Negeri 4 Bandung, pain points were obtained from their experience using online-based learning evaluations. Thus, it is necessary to design a user interface and user experience (UI/UX) learning evaluation on eCraft2Learn to overcome these pain points using the design thinking method. This design is carried out through five stages, namely empathize, define, ideate, prototype, and test. With this design, a UI/UX design is produced that can increase students' intrinsic motivation when doing evaluations. Intrinsic motivation is significantly related to the completion of a task. Therefore, the measurement results from user experience through the User Experience Questionnaire (UEQ) are above average, and the UI/UX design that has been designed has a positive effect on the interest or pleasure subscale and the perceived choice subscale.

ARTICLE INFO

Article History:

Submitted/Received 18 Aug 2022

First Revised 30 Aug 2022

Accepted 06 Mar 2022

First Available Online 23 Jun 2023

Publication Date 01 Jul 2023

Keyword:

Artificial intelligence,

E-Learning,

Learning evaluation,

Learning motivation,

UI/UX.

1. INTRODUCTION

E-learning is the use of Internet technology to deliver a series of solutions that can improve knowledge and skills. Web-based e-learning is a learning method that makes it easier for students to learn without space and time barriers. There are many lessons that students can learn, one of which is learning about artificial intelligence. Artificial intelligence (AI) is a technique used to imitate the intelligence possessed by living things and inanimate objects to solve a problem (Fitriyani et al., 2021). The eCraft2Learn website is an e-learning developed by Ken Kahn and Niall Winters. The e-learning provides learning about AI and can be accessed at <https://ecraft2learn.github.io/ai/link>.

In the learning process of students, of course, there is self-influence to encourage them to follow learning activities, which can be called motivation. Motivation is divided into two types, namely extrinsic and intrinsic motivation. Extrinsic motivation is motivation that is influenced by the external environment (Suharni and Purwanti, 2018). While intrinsic motivation relates to activities carried out for their own interests or for interests inherent in individual interests and pleasures. According to Ryan and Deci (2000), the learning motivation that is better at predicting academic achievement is intrinsic learning motivation.

In the educational process, tests and the measurement or evaluation of learning are factors that need to be considered. The results of the evaluation are needed to determine various goals in decision-making, including selection, placement, prediction, curriculum development, improvement of the teaching-learning process, and accountability for the implementation of educational programs. Learning evaluation can be interpreted as the process of collecting data to determine the quality of learning and knowing the extent to which educational goals have been achieved in order to make a decision for the next learning program (Widoyoko and Putro, 2013).

One of the problems faced by the world of education is the problem of weak learning processes and learning evaluation. One example can be presented as findings regarding the use of motivation, media, and methods that suit student characteristics to optimize student sensory sensitivity. The influence of user interface and user experience in the creation of learning media plays an important role so that users can feel a sense of comfort and experience with every feature used. User interface (UI) is when the system and users can interact with each other through commands as well as using content and entering data. User experience (UX) is mentioned as an experience related to user reactions, perceptions, behaviors, emotions, and thoughts when using the system. Design thinking is an approach to making an experience that involves emotional, aesthetic, and social value-oriented interactions.

Based on field studies through interviews with grade XI students majoring in RPL SMKN 4 Bandung, several opinions were obtained regarding the work on learning evaluation in e-learning. Students said that the work on learning evaluation felt very boring, had an unattractive appearance, and made them feel confused when doing learning evaluations on e-learning that they had done. According to the students, the user interface and user experience of learning evaluation in e-learning were still very unpopular, which made student motivation to use e-learning less.

2. METHODS

Mixed methods are a research method used in this study by combining qualitative and quantitative methods. Quantitative methods were conducted to measure students' intrinsic

learning motivation using the Intrinsic Motivation Inventory (IMI) questionnaire. IMI is a multidimensional measurement tool aimed at examining the subjective experience of participants' relationship with activity (Monteiro et al., 2015). In addition, quantitative methods are carried out for user experience assessment using User Experience Questionnaire (UEQ) questionnaires. The main purpose of UEQ is to enable rapid and direct measurement of user experience from interactive products. In the qualitative method, the research was conducted through user interviews with student representatives according to persona criteria to explore deeper knowledge related to pain points and user needs.

In the approach used for design reference, which is design thinking, there are five stages in the design thinking method, namely:

(i) Empathize

The design thinking approach emphasizes the focus of the thinking process on human values as users and humanity itself. Not surprisingly, empathy is the first step in creating innovation. The empathize process is the process of conducting activities to find out user needs by conducting interviews and observing their needs.

(ii) Define

After we try to understand human and human values through empathy, there needs to be a definition of problem statements taken from information obtained through observation using empathy in the first stage. At the define stage, it is useful to describe the user's ideas or views as the basis of the application product to be created and make a list of user needs.

(iii) Ideate

Ideate is the stage of developing the idea or solution needed. At this stage, it can be done by conducting an evaluation with the design team and combining the creativity of each application designer.

(iv) Prototype

Prototyping is the process of implementing ideas that have been obtained from the previous stage into an application or product that can be tested. This stage results in the finished product and application usage scenarios.

3. RESULTS AND DISCUSSION

3.1. eCraft2Learn UI/UX Design Results with Design Thinking Method

The UI/UX design of eCraft2Learn e-learning is designed based on user needs, pain points, and insights or opportunities from users. The target users of this eCraft2Learn website are people who want to learn the basics of machine learning and AI. In this study, the target users referred to are students of SMKN 4 Bandung Vocational High School in the PPLG Department. Based on the 5 stages of design thinking that have been explained in the research method, the following are the design results based on the design thinking method:

3.1.1. Empathize

At this stage, several steps and activities must be carried out. This activity was carried out to gain insight and find out the needs of users when using the eCraft2Learn website.

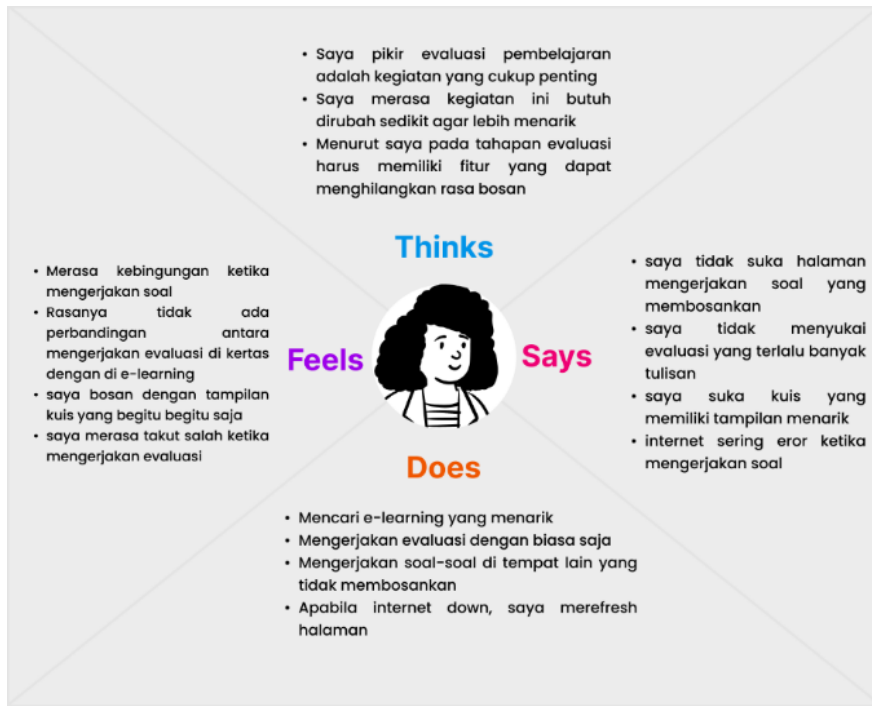


Figure 1. Empathy map.

Based on **Figure 1**, there are four categories of empathy. The thinks category means what is thought, says means what you want to say, does means what is done, and feels means what the persona feels about an existing e-learning design

3.1.2. Define

In this stage, analysis and understanding of various insights are carried out. The analysis was carried out by creating a mapping of the user journey map. Below is the mapping of persona 1, shown in **Figure 2**.

Person & Scenario	Persona 1				
Phase	Study plan	Opening E-learning	Read the material	Work on evaluations	After learning
Actions	<ul style="list-style-type: none"> • Set up your device for learning • Setting up an internet connection • Prepare material that has been studied 	<ul style="list-style-type: none"> • Unlock your device • Go to the E-learning platform site • Browse E-learning 	<ul style="list-style-type: none"> • Read the materials provided • Understand learning • Record learning in the most important parts • Try to practice if there is practical material 	<ul style="list-style-type: none"> • Understand the form of evaluation • Work on evaluations • Ensure a secure connection • Make sure what is done is correct • Complete the evaluation 	<ul style="list-style-type: none"> • Ensure learning comprehension • Take a look at the next lesson • Closing E-learning
Poin Points	<ul style="list-style-type: none"> • Platform not compatible with device • Unstable / bad connection 	<ul style="list-style-type: none"> • Site cannot be opened • E-learning does not recognize users • Unattractive look 	<ul style="list-style-type: none"> • The material provided is boring • Not understanding the material • The delivery of the material is difficult to understand 	<ul style="list-style-type: none"> • Fear of being wrong when doing evaluations • The connection is suddenly not good • There was an error while doing the evaluation • Don't know what has been done 	<ul style="list-style-type: none"> • Didn't get any knowledge • Subsequent learning unknown • What has been done is not stored on the site
Insight/ Opportunities	<ul style="list-style-type: none"> • A compatible platform for any device that can open a browser • The material prepared is material that has been validated 	<ul style="list-style-type: none"> • The platform has a profile for each user • The display is shaped attractive and fun to look at 	<ul style="list-style-type: none"> • The material provided is shaped attractive and neat to make it comfortable to learn • The display of the material is formed easy to understand 	<ul style="list-style-type: none"> • Guide feature or instructions that can help you understand what to do • There is a feature that can look back on the results of previous work • The score or grade will appear after the work as well as the results of the answers and the explanation of the answers 	<ul style="list-style-type: none"> • Learning outcomes can be reviewed • The next learning is user-viewable • All learning and evaluation results are stored by the platform so that users can look back at it.

Figure 2. User Journey Map Persona 1.

Below is the mapping of persona 2, shown in **Figure 3**.

Person & Scenario	Persona 2				
Phase	Study plan	Opening E-learning	Read the material	Work on evaluations	After learning
Actions	<ul style="list-style-type: none"> Set up your device for learning Setting up an internet connection 	<ul style="list-style-type: none"> Unlock your device Go to the E-learning platform site Browse E-learning 	<ul style="list-style-type: none"> Read the materials provided Understand learning Record learning in the most important parts Try to practice if there is practical material 	<ul style="list-style-type: none"> Understand the form of evaluation Work on evaluations Ensure a secure connection Make sure what is done is correct Complete the evaluation 	<ul style="list-style-type: none"> Ensure learning comprehension Take a look at the next lesson Closing E-learning
Poin Points	<ul style="list-style-type: none"> Platform not compatible with device Unstable / bad connection Don't understand at all 	<ul style="list-style-type: none"> Site cannot be opened E-learning does not recognize users Unattractive look 	<ul style="list-style-type: none"> The material provided is boring Not understanding the material The delivery of the material is difficult to understand 	<ul style="list-style-type: none"> Not understanding the form of evaluation Fear of being wrong when doing evaluations The connection is suddenly not good Don't understand what to do Not knowing the right answer 	<ul style="list-style-type: none"> Didn't get any knowledge Don't understand the whole platform Feeling that there is nothing interesting
Insight/ Opportunities	<ul style="list-style-type: none"> A compatible platform for any device that can open a browser The material prepared is material that has been validated 	<ul style="list-style-type: none"> The platform has a profile for each user The display is shaped attractive and fun to look at 	<ul style="list-style-type: none"> The material provided is shaped attractive and neat to make it comfortable to learn The display of the material is formed easy to understand 	<ul style="list-style-type: none"> The form of evaluation is formed familiar by users, namely in the form of multiple choice quizzes and practice quizzes Guide feature or instructions that can help you understand what to do The score or grade will appear after the work as well as the results of the answers and the explanation of the answers There are points collection features and leaderboards as gamification in the evaluation process 	<ul style="list-style-type: none"> Learning outcomes can be reviewed Provided with a question answer explanation feature The display is attractive and easy for users to understand so as not to be boring

Figure 3. User Journey Map Persona 2.

Figure 2 represents the user journey map for persona 1. The user journey map gets insight into persona 1's pain points, where it is said that the persona feels afraid when doing evaluations, connections are not good, and making mistakes when doing evaluations makes them feel that they do not know whether what is done is the best result. In **Figure 3**, which shows the user journey map persona 2, the slight difference between the two user journey maps above is in the persona pain points section. Persona pain points on the user journey map lead more to the persona's incomprehension of the form of evaluation and the content of the material in the evaluation section.

3.1.3. Ideate

In this stage, ideas or solutions are made from problems that have been formulated. Ideas or solutions to solve problems that have been determined are poured into the design of the user flow.

Figure 4 shows the user flow when using the eCraft2Learn website. The flow shows from the beginning of the page to the courses page to learn the material first, then to the quiz page, where the learning evaluation process is carried out. Then the flow also shows that users can see profiles where they can see user data. Then the user is also directed to the Project page flow, where this page contains the projects that the user has and wants to create.

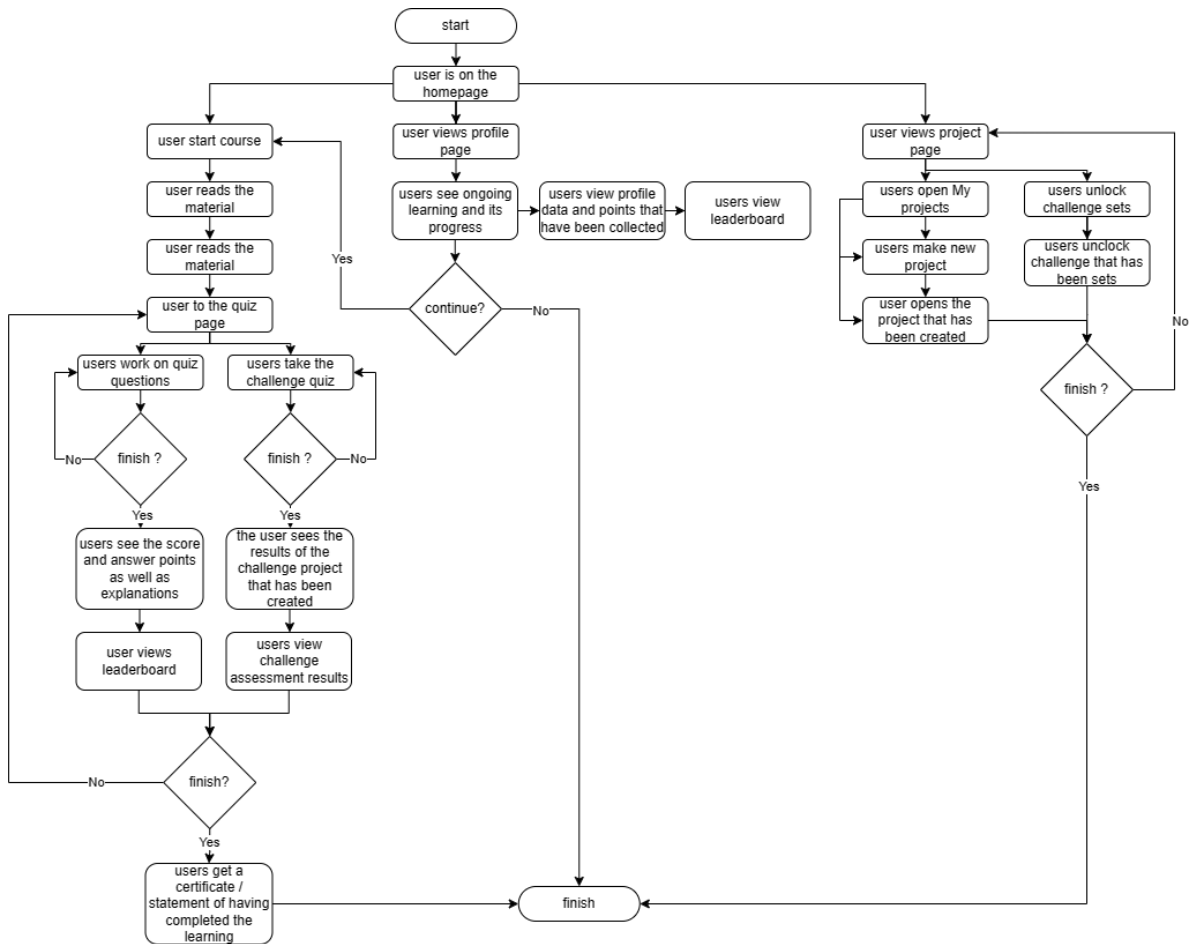


Figure 4. User flow.

3.1.4. Prototype

At this stage, prototype design is carried out based on the results of research that has been done before. The prototype design is a form of high-fidelity. The prototype is shown in Figure 5.

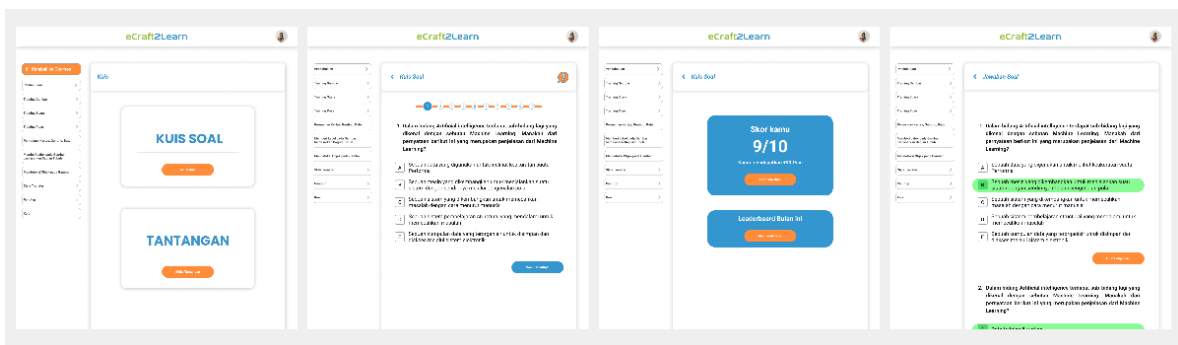


Figure 5. Prototype.

The high-fidelity design that can be seen in Figure 5 is a hi-fi design of the quiz page, quiz questions, quiz results, and questions and answers. The hi-fi design is designed to follow the pre-made user flow design. The design system that has been created has been applied or used in this hi-fi design, with the use of color, fonts, buttons, and other features.

3.1.5. Testing

At this stage, participants test the design that has been made, after which they are directed to fill out the System Usability Scale (SUS) questionnaire for usability measurement on the design that has been made. The following are the results of usability testing with the System Usability Scale (SUS) instrument presented in **Table 1**.

Table 1. SUS result.

Participant	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
1	4	1	4	2	4	1	4	2	4	3
2	5	1	4	2	5	1	5	1	5	2
3	5	1	5	1	5	1	5	1	4	2
4	4	1	4	2	5	2	4	1	4	2
5	5	1	5	2	4	1	4	2	4	2

Table 2 shows the results of participants' responses to the design. Based on the data, the design feels good for its usefulness. It can be seen from the calculation of the SUS scale in Table 2, which has obtained an average value of 86.5. With the results of this value, it can be stated that this design is the best imaginable, or, in other words, this design is very good to proceed to the next stage.

Table 2. The result of the calculation of the SUS scale.

Scales			
Odd items	Even items	SUS score (/100)	Grades
15	16	77.5	B
19	18	92.5	A
19	19	95	A
16	17	82.5	A
17	17	85	A
Average skor SUS		86.5	A

3.2. User Experience Assessment on UI/UX Design

After all stages of design thinking are carried out, the user experience assessment can be continued, which is carried out again for students in grades XI PPLG 2 SMK Negeri 4 Bandung. Here is a visualization of the UEQ results that can be seen in **Figure 6**.

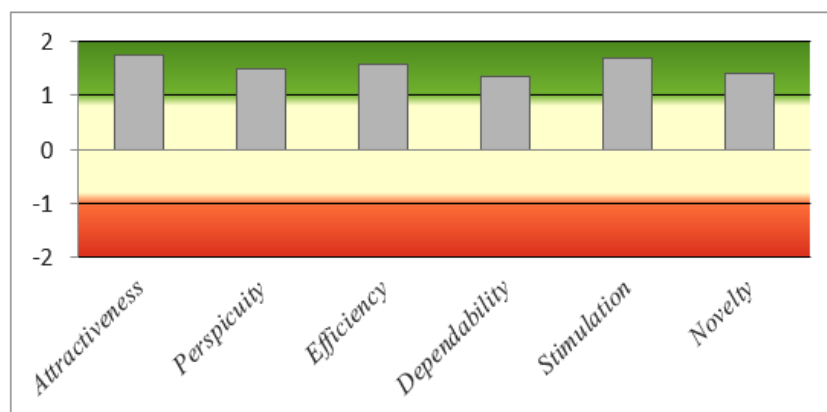


Figure 6. UEQ Graphic Result

3.3. Intrinsic Learning Motivation Assessment

This increase in intrinsic learning motivation is measured by doing as many as two cycles. The first cycle is without practice, and the second is learning the evaluation section with the eCraft2Learn website that has been developed. Based on the discussion of the Intrinsic Motivation Inventory (IMI) instrument in Chapter 2, there are 4 subscales divided for the measurement, including interest/pleasure, perceived competence, perceived choice, and pressure/tension. The results of increased learning motivation are presented in **Figure 7**.

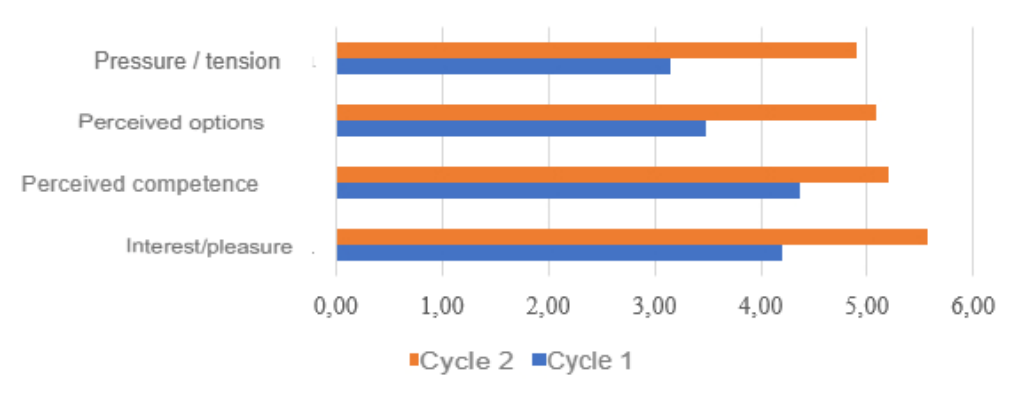


Figure 7. Graph of the intrinsic learning motivation scale.

3.4. The Effect of UI/UX Design on Intrinsic Learning Motivation

In this study, the increase in motivation will be influenced by UI/UX design by referring to the measurement of User Experience Questionnaire (UEQ) and Intrinsic Motivation Inventory (IMI). Based on the participants' answers to the UEQ and IMI questionnaires, data processing was carried out using the Gain Test to find out how the UI/UX of the eCraft2Learn website improved the test results. The improvement can be seen in **Table 3**.

Table 3. Intrinsic motivation N-Gain test results.

Motivation Scale	Categori N-Gain	N
Interests/pleasures	Tall	8
	Keep	14
	Low	8
Perceived competence	Tall	1
	Keep	14
	Low	15
Perceived choice	Tall	2
	Keep	20
	Low	8
Pressure/tension	Tall	2
	Keep	7
	Low	21

Table 3 displays the results of the Intrinsic Motivation N-Gain Test from cycles 1 and 2. On the interest/pleasure subscale, there were 8 students who had an increase in the high category, 14 students who had an increase in the medium category, and 8 students who had an increase in the low category. Furthermore, on the perceived competency subscale, there was 1 student who had a high category improvement, 14 students who had a moderate category improvement, and 15 students who had a low category improvement. On the

perceived choice subscale, there were 2 students who had an increase in the high category, 20 students who had an increase in the medium category, and 8 students who had an increase in the low category.

With the acquisition of these results, the influence of UI/UX design on student learning motivation can be tested. The test is performed using a simple linear regression test. Here are the results of the test.

Table 4. Results of simple linear regression coefficients.

Bound Variables	Unstandardized Coefficients B		T	Sig.
	(Constant)	UI/UX		
Interests/pleasures	.253	.146	2.500	.019
Perceived competence	.242	.040	0.705	.487
Perceived choice	.218	.140	3.455	.002
Pressure/tension	.409	.004	0.068	.946

The significance value of the interest/pleasure subscale from Table 4 is above $0.019 < 0.05$, so it can be concluded that the UI/UX result variable (X) has an effect on the interest/pleasure subscale variable (Y1). Furthermore, on the perceived competency subscale, the result of the significance value is $0.487 > 0.05$, which means that the UI/UX (X) result variable has no effect on the perceived competency subscale variable (Y1). Meanwhile, the significance in the perceived choice subscale is $0.002 < 0.05$, then it can be concluded that the UI/UX (X) result variable has an effect on the perceived choice subscale variable (Y1). Finally, the significant value on the pressure/tension subscale is $0.946 > 0.05$, which means that it can be concluded that the UI/UX result variable (X) has no effect on the pressure/tension subscale variable (Y1).

4. CONCLUSION

Based on the results of research that has been conducted on UI/UX design in the web-based learning evaluation of artificial intelligence e-learning on intrinsic learning motivation with a design thinking approach, it can be concluded that the UI/UX design is in accordance with the user needs. The results of this design can be said to be appropriate and have a positive impact. This is also supported by the user experience measurements that get above-average values. The results of the User Experience Questionnaire (UEQ) after designing the user interface design and user experience of the eCraft2Learn e-learning website are significantly increasing at every scale. Based on the results of the linear regression test, it was found that the user interface design and user experience in the learning evaluation of the eCraft2Learn e-learning website had a significant positive effect on the subscales of interest/pleasure and perceived choice. This was obtained based on the significance value of the interest/pleasure subscale of $0.019 < 0.05$ and the perceived significance value of the preferred subscale of $0.002 < 0.05$. Even so, this UI/UX design has no effect on the other two subscales, which are perceived competence and pressure/tension.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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