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USER EXPERIENCE QUESTIONER AND HEURISTICS EVALUATION IN ONLINE LEARNING ENVIRONMENT

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ABSTRACT

Online learning has an important role to support learning activities. Although it has been widely used by various universities, there is always effort to increase the interest of the user using a system of online learning which can be measured through user experience. Several quantitative and qualitative studies have been conducted to measure online learning from the aspect of the user experience; however, such a study is still arranged separately. This research discusses user experience measurement using two methods, namely user experience questioner (UEQ) as a quantitative study and evaluation heuristics (HE) as a qualitative study. The data retrieving in the measurement of user experience is run by distributing questionnaires to 100 students of the online-learning program in University xyz. Subsequently, the data was analyzed by employing UEQ and HE. The research results showed that the input and suggestions form users online learning is relatively similar. Results on UEQ attractiveness resulted in highest value and the novelty aspect of the lowest. While the results HE all aspects which had a good evaluation of the results, however there is still deficiencies which in the measurement HE will further detailing of which parts should be more focused on. On the final results, there are suggestions that HE may be the fix for combining UEQ and HE cannot be done, because each has its own distinctive aspects in the measurement. But both can complement the results of research with their respective advantages.

Keywords: *UX; User experience; the questioner heuristics evaluation; Online learning*

1. INTRODUCTION

Now, various universities in Indonesia have been utilizing the online learning to support teaching and learning. University xyz is one of the private universities in Indonesia that have implemented the online learning (xyz Online Learning) in teaching and learning activities for all students: in various regions and foreign countries. xyz Online Learning is e-Learning System for the necessities of teaching and learning activities ranging from email, schedule, grades, discussion forums, students and professors, assignment uploads, sharing information and bill payment information.

However, although xyz Online Learning has been implemented for approximately seven years, the system has not been tested for user experience, so it does not explicate how well students use the system and what improvements should be made. As a system, xyz Online Learning certainly has advantages, and the shortcomings of the students as users. The interest of users using a system can be distinguished by measuring the user experience viewed from the perspective of the user [1]. Measurement of user experience aims to evaluate a system in which the results of the measurement of each aspect of the user experience can produce a recommendation in its development [2].

Some studies have measured the user experience of an e-Learning system, such as: measuring e-Learning based user experience Questioner (UEQ) [3][4] and using a heuristic evaluation (HE) in the online learning environment [5][6]. The UEQ approach is a quantitative method of quantitative user experience with the analyzed model of the 6 aspects of Attractiveness, Efficiency, Perspicuity, Dependability, Stimulation, and Novelty [7].

While the HE approach, qualitative measurements that pay attention to 10 aspects: visibility of system status, match between system and the real world, user control and freedom,

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consistency and standards, error prevention, recognition rather than recall, flexibility and efficiency of use, aesthetic and minimalist design, help users recognize, diagnose and recover from errors, help, and documentation [8] Nevertheless, existing research to measure user experience online learning has not been done thoroughly in using UEQ f and HE.

Therefore, to estimate the user experience as a whole and complement, each other can be used both methods. This research is sharpened to overcome the problems in apprehending the user experience of students at xyz Online Learning in quantitative study using UEQ and qualitative study by using HE.

2. RESEARCH METHODOLOGY

2.1. Data sets

Data collection was performed by distributing UEQ and HE questionnaires online by using Google form facility to the online students of University xyz. There were 100 students who fill the UEQ and HE questionnaires.

Table 1. Demographic analysis for participants

Variable	Data
Participant	Online learning student : Undergraduate (50 participant) Graduate (50 participant)
Social media used	Google form Whatsup (with link to connect google form) DM Instagram (with link to connect google form)

The form of the UEQ questionnaire has been described in figure 1 above. While the HE questionnaire was done by considering the 10 aspects associated with online learning system of University xyz. Subsequently, provided a column that people can fill in according to their experiences and suggestions.

2.2. Related works

User experience discusses how users feel and what they feel when using a product/system [9] The purpose of User Experience is to know whether the user is comfortable, the system design is simple, easy to accept by the user, the use of the process can give comfort and access as per the user[10] Measurement of user experience using several methods, such as User Experience Question (UEQ) Heuristics Evaluation (HE), and so on. UEQ is a tool for measuring the user experience of a system and is available on the website http://www.ueq-online.org/ The UEQ questionnaire is quantitative and is available in various languages, such as English, German, Spanish, Chinese, Indonesian, and so on. Figure 1 shows the UEQ English version.

	1	2	3	4	5	6	7		
annoying	○	○	○	○	○	○	○	enjoyable	1
not understandable	○	○	○	○	○	○	○	understandable	2
creative	○	○	○	○	○	○	○	dull	3
easy to learn	○	○	○	○	○	○	○	difficult to learn	4
valuable	○	○	○	○	○	○	○	inferior	5
boring	○	○	○	○	○	○	○	exciting	6
not interesting	○	○	○	○	○	○	○	interesting	7
unpredictable	○	○	○	○	○	○	○	predictable	8
fast	○	○	○	○	○	○	○	slow	9
inventive	○	○	○	○	○	○	○	conventional	10
obstructive	○	○	○	○	○	○	○	supportive	11
good	○	○	○	○	○	○	○	bad	12
complicated	○	○	○	○	○	○	○	easy	13
unlikable	○	○	○	○	○	○	○	pleasing	14
usual	○	○	○	○	○	○	○	leading edge	15
unpleasant	○	○	○	○	○	○	○	pleasant	16
secure	○	○	○	○	○	○	○	not secure	17
motivating	○	○	○	○	○	○	○	demotivating	18
meets expectations	○	○	○	○	○	○	○	does not meet expectations	19
inefficient	○	○	○	○	○	○	○	efficient	20
clear	○	○	○	○	○	○	○	confusing	21
impractical	○	○	○	○	○	○	○	practical	22
organized	○	○	○	○	○	○	○	cluttered	23
attractive	○	○	○	○	○	○	○	unattractive	24
friendly	○	○	○	○	○	○	○	unfriendly	25
conservative	○	○	○	○	○	○	○	innovative	26

Figure 1. UEQ English Version [7]

Figure 1 shows 26 questions with a 7-likert scale, with intervals of 1 to 7 [11] The UEQ question represents six aspects of user experience measurement: which are (1) Attractiveness as to whether the system/product is favored/disliked by its users; (2) Efficiency related to whether the system/product is easy to use and easy to learn; (3) Perspicuity related to whether the user resolves the problem on the system without effort assistance; (4) Dependability as to whether the user perceives the interaction in a controlled system; (5) Stimulation of whether the system/product makes the user motivated to use it; and (6) Novelty whether the product is innovative, creative and appealing [12] [13] [14].

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To calculate the interval of UEQ is from -3 (horribly bad) to +3 (extremely good) [7]. Figure 2 is an example of a graph results UEQ for results excellent. Tabel 1 explain, 26 questions will be grouped based on 6 UEQ aspects which will be distributed with the number of questionnaires participants so that it gets the average score result on every aspect of UEQ.

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Table 2. Grouping questions based on aspects of UEQ

Aspects of UEQ	No. Questions
Attractiveness	1. annoying/enjoyable; 12. good/bad; 14. unlikable/pleasing; 16. The unpleasant/pleasant; 24.attractive / unattractive; 25.friendly / unfriendly
Perspicuity	2. not understandable / understandable; 4. easy to learn / difficult to learn; 13. complicated / easy; 21. clear / confusing
Efficiency	9. fast / slow; 20.inefficient / efficient; 22. impractical / practical; 23. organized / cluttered
Dependability	8. unpredictable / predictable; 11. obstructive / supportive; 17. secure/ insecure; 19. meet the expectations / does not meet the expectations
Stimulation	5. valuable / inferior; 6. boring / exciting; 7. not interesting / interesting; 18. motivating / demotivating
Novelty	3. creative / dull; 10. inventive / conventional; 15. usual / leading edge; 26. conservative / innovative

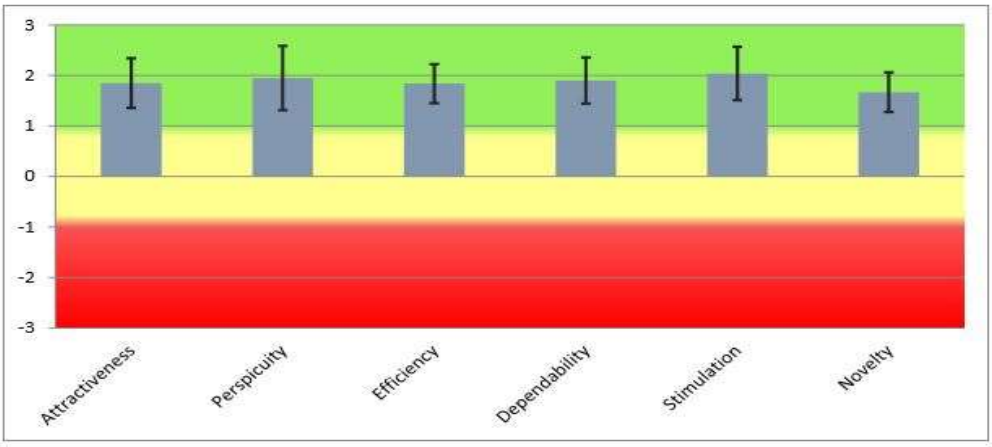

Figure 2. Samples of products with Good Results [7]

User Experience measurements using UEQ have been used to measure e-learning at the Faculty of Computer Science, the University of Indonesia[3]. Then the measurement of user experience using UEQ against iDigital Museum system, with a case study of interactive applications for the theme of Bandung Purba [13]. HE method is an evaluation of user experience on a system based on qualitative feedback from users. Table 1 shows the 10 aspects measured using a HE [14].

Table 3. Aspect HE and the purposes

Aspects	Purposes
Visibility of system status (A1)	The system should always provide information about what process is going through a feedback.
Match between system and the real world (A2)	The system should speak in accordance with the user's language.
User control and freedom (A3)	Users often make mistakes in the selection of system functions and want to immediately leave, all it takes is an undo.
Consistency and standards (A4)	User should not have a different idea of a word, situation or action, all following an existing platform, by agreement or by default,

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Error-prevention (A5)	A good system will be designed to prevent users from making mistakes, by displaying a confirmation selection of the activities the user will perform
Recognition rather than recall (A6)	Minimize the users in thinking or remembering things against objects, actions, and choices. All instructions in the system are clear and easy for the user.
Flexibility and efficiency of the usage of (A7)	Acceleration, meaning the system is made in order to work fast and easy to use even though the user is new or expert
Help users recognize diagnose and recover from errors (A8)	Error messages should be described using clear language (not using code), explaining the problem, and providing suggestions as solutions
Aesthetic and minimalist design (A9)	The dialog that appears should not contain irrelevant or unnecessary information
Help and documentation (A10)	The need for help and documentation of system usage.

The HE method has been used in the online shopping portal evaluation at Lublin University of Technology, Poland. The result shows that the testing of expert user experience is more focused on the interface system [5]. Table 3 shows the HE questionnaire to measure user experience to online students of University xyz.

Table 4. The design of the HE Questionnaire is based on Online Learning xyz

Aspects	System Online Learning xyz	Experiences and Suggestions user
A1	Display and icon that are displayed are familiar, easy-to-understand, attractive and information feedback is available as it could give confidence that the process has been conducted.	Experiences:…. Suggestions:….
A2	Use English consistently on every feature and menu in the system	Experiences:…. Suggestions:….
A3	The use of the feature back on the system in accordance with the behavior of users	Experiences:…. Suggestions:….
(A4)	Standardization on the display toolbar and icon in the system	Experiences:…. Suggestions:….
(A5)	system well provides the confirmation regarding activities or choices	Experiences:…. Suggestions:….
(A6)	The icons that are used in the system are familiar for its users	Experiences:…. Suggestions:….
(A7)	The system is easily understood by its users and undergoes infrequent problems	Experiences:…. Suggestions:….
(A8)	the system provides an error message with a language that is easy to be understood by users	Experiences:…. Suggestions:….
(A9)	Warning on dashboard system is in compliance with the needs of users	Experiences:…. Suggestions:….
(A10)	Warning on dashboard system is in compliance with the needs of users	Experiences:…. Suggestions:….

4. RESULT

In this section described the results of the measurements UEQ and HE. This result as the basis for development of recommendations xyz online learning.

4.1 Measurement of UEQ

Figure 3 and Table 4 show the results of the UEQ measurement of online learning at

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University xyz using 6 aspects. If aspect is included in the interval of 0.0 up to 3.0 points, so it can be concluded that the result is neutral (standard), and if interval of -0.3 up to 0.0 points, so it can be concluded that the result is not standard. Attractiveness was at 1,118 points. It can be concluded that the result is neutral (standard). These results indicated that xyz online learning is already good enough in some existing measurement in aspect of attractiveness that is: according to the student, the system is quite good, pleasant, pleasing, friendly, attractive and pleasant.

Then, perspicuity was at points 1,015. It it can be concluded that the result is neutral (standard). These results indicate that xyz online learning is already good enough in some existing measurement in aspect of perspicuity that is according to the student system is quite understandable, easy to learn, easy (simple) and clear. Efficiency was at the point of 0.910. It can be concluded that the result is neutral (standard). These results indicated that xyz online learning is already good enough in some existing measurement in aspect of efficiency: according to the student, system is quite efficient, fast, well organized and practical.

Dependability was at points of 1,043. It can be concluded the result is neutral (standard). These results indicated that xyz online learning is already good enough in the aspect of dependability, that according to students, the system is supporting enough, predictable, secure and fulfilling the expectations. Stimulation is on points of 0.983. It can be concluded that the result is neutral (standard). These results indicated that xyz online learning is already good enough in some existing measurement in aspect of stimulation: according to the student system is quite useful, engrossing (existing), interesting and motivating.

While, novelty is at the points of 0.333. It can be concluded the result is neutral (standard). These results indicated that xyz online learning is already good enough in some existing measurement in aspect of efficiency: according to the student, system is quite efficient, fast, well organized and practical.

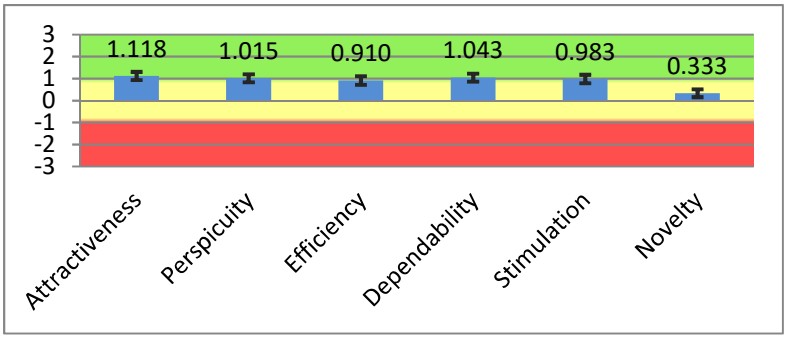

Figure 3. Is a Graph results of measurement aspect UEQ

Table 5. Scale measurement results

UEQ Scales	
Attractiveness	1.118
Perspicuity	1.015
Efficiency	0.910
Dependability	1.043
Stimulation	0.983
Novelty	0.333

Based on the results of the measurements, aspect of attractiveness, online learning platform of university xyz got the highest points while the lowest points is novelty aspect; the overall points are indeed on the evaluation standard of points or intervals is quite good, however by the presence one of the aspects that have a low value in aspect of novelty, it held a further evaluation of some points on the novelty aspect i.e. creative, inventive, leading and innovative systems to improve quality xyz online learning.

4.2 Measurement of HE

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Measurement results from HE at xyz online learning using 10 aspects. Table 5 shows the result of HE for each aspect. Measurement results from HE at xyz online learning online learning using 10 aspects. A table 4-13 below shows the result of HE for each aspects [8].

Table 6. Results HE aspects of visibility of system status

Aspect	Comment	
	Opinion	Advice/expected on systems
(A1)	• Display and icon that are displayed are familiar but there are some icons are not familiar and less understandable, as for example in the section exist schedule feature icon on the chat icon, instructions on the system are obvious. • The system pretty easily understood. looks interesting • Every open dashboard notice always appear a little annoying if you're hurry want to access tasks.	• Give information on icon labels that are not too familiar to users. • If you have to write in the forum, should not appear reminder email again. • Suggestions for system now if click the forum on schedule then display the dedicated forum less friendly, uncomfortable in such a mess, look different if we directly click the forums will appear the schedules arranged according to mess with the date.

In general, students argued that aspects of the visibility of system status on the online learning xyz are familiar and easy to understand. However, on the dashboard needs to be fixed. Therefore, the advice given students to note such as adding information on icon labels are not familiar and most opinion that.

Table 7. Results HE Aspects match between system and the real world

Aspect	Comment	
	Opinion	Advice/expected on systems
(A2)	• The language used is understandable and tailored to its users. • The use of the language was already consistent for every feature of the menu that is using English	• Better using good language menu type 1 as well as the content, but the user can replace it with another language if they wish. • There has not been a selection of the language.

In general, students argued that aspects match the system and the real world in online learning xyz learning as it has used language that is easy to understand and consistent in every menu. However, some features are not yet available in several languages. Therefore, the advice given students to note such as add a language selection on the system in accordance with the language of the user.

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Table 8. Results HE aspects of user control and freedom

Aspect	Comment	
	Opinion	**Advice/expected on systems**
(A3)	• The user controls are indeed needed because users often use the featured back on smartphone. • Use of the back button depending on user behavior. • On the web, there is no direct back function, its weaknesses and we should wait for a few seconds in order to return to the previous display menu and mostly also cannot open in multiple tabs at the same time, the example assignment • System has a function that is not in a scope or main menus not always appearing. Users often are forced to follow the flow of the system without free choice.	• It should provide a sitemap or guidance in its use in order to make it easier for its users. • Evaluation suggestions menu back by viewing habits of users, so that users are comfortable using the system • Advice we recommend some of the menu can be opened simultaneously in the new tab.

In general students argued that aspects of user control and freedom in online learning xyz in terms of user controls assessed student use of the function of the back depending on the behavior of its users. However, back on the menu in the system need to be further evaluated by looking at the user's habits. Therefore, the advice given by students has to be noted such as create a menu on the system can be opened in a new tab the information label on the icon which is not familiar and most opinions suggest that the system need to provide usage instructions.

Table 9. Results consistency Aspect of HE and standards

Aspect	Comment	
	Opinion	Advice/expected on systems
(A4)	• Display, icon, toolbar and others in the system are already good and standard • The menu is displayed for a certain different options with other options, so that the frame of the built system for users is quite confusing because it does not have the same base.	• consistency in the display of the menu and the very Language needed in the system therefore should look familiar and the language used should be clear also avoid ambiguous words

I n general student s argued that aspects

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of consistency and standards on online learning system overall overview online learning xyz is already good and consistent. However, there are some menu when selected by the user is still making confused so that needs to be fixed. Therefore, the advice given students to note such as paying attention to the display's menu and language on the system.

Table 10. Result of HE Aspect error-prevention

Aspect	Comment	
	Opinion	Advice/expected on systems
(A5)	• On some systems there are already activities against confirmation/ votes conducted so that enough makes it easy	• We recommend that you added captions (kind of tools tips) sentences when the cursor is pointed to one of the menu. • Suggestions on the Forum on mobile applications can post an answer blank when not depressed Reply button

In general students argued aspects of the error-prevention on online learning has been providing confirmation that online learning xyz in some action in the system have been good. However, on the use of the via mobile, there is still the problem of IE if accidentally in reply then it would empty answer will be posted without notice of these things need to be fixed. Therefore, the advice given students to note such as adding annotations (box informers) if the cursor is brought near in the menu.

Table 11. Results HE aspects of recognition rather than recall

Aspect	Comment	
	Opinion	Advice/expected on systems
(A6)	• Icons chosen has been very familiar so that it makes ease for users to use • In private Chat menu on the system is somewhat rarely used because users are more comfortable communicating with social media respectively.	• To review menu chat among students in the system, probably it is more comfortable if student can connect to other medias

In general students argued aspects of recognition rather than recall on online learning xyz selection icons are familiar. However, on the chat menu for intercultural students are very rarely used.

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Therefore, the advice given students to note such as re-evaluating the usability features of chat for students to look at their convenience when using the system.

Table 12. Results HE aspects of flexibility and efficiency of the usage

Aspect	Comment	
	Opinion	Advice/expected on systems
(A7)	• The system is easy to understand but less practical and sometimes confusing for new people. • Cannot right click open in new tab. • Often going down by a particular system on some times	• Advice: should be more facilitated on choice of menus for example if one is to use the design of Microsoft because most people are familiar with the design • Suggestion on the part of the function click on each module of subject that usually appears on the dashboard, it cannot open new tab. If we use the function open new tab then that tab is simply a blank will appear It feels like this should be remedied because every period not only contains 1 courses, but some subjects are very stiff if the user should open the procedurally per each subject. So, it should be multi tab in it. • System performance must be at the monitor at regular intervals to avoid down time at certain times.

In general students argued that aspects of the flexibility and efficiency of the usage of on online learning xyz systems have easy to understand. However, it often happens down the system. The menu system is also not able to click on the new tab to add them to these needs to be fixed. Therefore, the advice given students to note, such as the need to perform system monitoring on a regular basis and make the system able to perform a new tab on each menu.

Table 13. Results of HE Aspects help users recognize diagnose and recover from errors

Aspect	Comment	
	Opinion	Advice/expected on systems
(A8)	• The error message was clear. • His "success" text when uploading was error sometimes. Sometimes when the failed upload task is not accompanied by an error message, just swirl it, While if there is writing direct success successful but not direct upload tab closed	• Suggestion error message should be detailed but not excessive and by using clear language so that users will be more quickly know his faults

In general, students argued that Aspects help users recognize diagnose and recover from errors on online learning xyz message was clear. However, the info when the action successfully on the system error sometimes this needs to be fixed. Therefore, the advice given the student a more

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noteworthy error messages so that users readily understand.

Table 14. Results HE Aspects of aesthetic and minimalist design

Aspect	Comment	
	Opinion	Advice/expected on systems
(A9)	• Design a bulletin board on the system's been good but Warning dashboard is irrelevant. students must read the news over and over again for news not for the student (such as graduation announcements etc.) information that appears should not be combined with students at different levels so that information is right on target	• Suggestions the announcement should be made in the form of slides, so when opening dashboard doesn't show up every time. • Might be better differentiated information dialog again if on each host. Short and clear dialogue is needed in the system

In general students argued aspects of the aesthetic and minimalist design on online learning xyz on menu boards is already good. However, votes are fewer contents less relevant it needs to be fixed. Therefore, the advice given students to note that is to select the contents of the notice boards in accordance force of each student (information is not universal).

Table 15. Results HE aspects of help and documentation

Aspect	Comment	
	Opinion	Advice/expected on systems
(A10)	• the Help menu provided such as the for ask question (FAQ) on a system is already well, but haven't quite helpful when students are having problems using the system • Usually for new students is still very difficult to learn so need help menu. • Yet the existence of the documentation of the use of the system can be kept by the student while accessing the website.	• Indispensable Advice: manual book for students for the use of LMS because short tutorial given at the time of introduction of the system of learning activities on line is not sufficient to provide the knowledge for new students in recognizing the features that are present in the LMS. Better existence tutorial using the system is in the form of a video. • Supplementary menu chat message in the system to get the help of Admins. • The need for the feature to upload proof to capture if the system is experiencing an interference

In general students argued aspects of the help and documentation on online learning xyz like menu for ask question (FAQ) provided is already good. However, it is reasonably less help students needs to be fixed. Therefore, the advice given students to note such as adding a menu chat directly with the admin when having problems while using the video and also provide another alternative to introduce the use of online learning at university

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xyz for example student manual book use or can be in the form.

5. CONCLUSION

User experience measurement results using UEQ showed study quantitative and qualitative studies UEQ measurement at university xyz, online learning shows all the aspects of the result is positive, despite the novelty aspect is very much the point between the points obtained by the other aspects namely > 0.8. Online learning xyz is expected to improve this aspect of novelty. HE measurement results according to a student demonstrating all aspects have been good and need development. However, in every aspect there are still drawbacks. Therefore, all student suggestions for development and improvement need to be accommodated by the online learning xyz. Measuring user experiences complement each other, using the method of quantitative measurements as UEQ and methods HE as qualitative measurement.

When conducting research using two methods, the thing that must be considered was the readiness of respondents to provide their willingness to fill out questionnaires. Because the respondents in this study were students who took online course so the researchers chose questionnaires for data dissemination, in this study respondents gave good feedback so that researchers were able to process data easily. It could be concluded that the input and opinions of the respondents showed that the improvement in xyz university online learning needed to be done especially in some aspects of the HE aspect.

In Indonesia, the application of UX measurement by using UEQ had been done for e-learning at University of Indonesia which aimed to find out the UX from the users of learning management systems (SCELE) in the Computer Science education, it was done by UX measurement that used multiple methods and the results were used as recommendations for improvement system for e-learning management at University of Indonesia. In this study, the main goal is same, namely to find out the opinions of users in using xyz university online learning in order to improve the performance of online learning. The difference from this research is the use of the second method, if research at University of Indonesia chose the second method in the form of direct interviews with the users, in this study the research will use questionnaire as the media, with expectation to be able to give the respondents plenty of time and opportunity to give their opinion so that the obtained-results are maximal. The contribution of this research is expected to be a reference for measuring user experience in the future studies.

The scope of user experience research is not only to study an information system or online learning. The use of this research can be done in other scopes such as measuring user experience of a product that will or has been launched, or it can also measure the satisfaction of customers. The methods used in this study are also available to be used in measuring a broad scope of user experience. Of course the use must be in accordance with the research needs that will be carried out.

Further research for the measurement of user experience in online learning not only using methods UEQ and HE, but may use other methods such as Usefulness, Satisfaction, and Ease of use (USE Questionnaire) and Everyday Technology Use Questionnaire (UTEQ). Objects can also be extended to online learning in Indonesia.

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