# User experience evaluation of e-report application using cognitive walkthrough (cw), heuristic evaluation (he) and user experience questionnaire (ueq)

# User experience evaluation of e-report application using cognitive walkthrough (cw), heuristic evaluation (he) and user experience questionnaire (ueq)

**P W S Dewi[1], G R Dantes[2], G Indrawan[3]**

Computer Science Program Study Ganesha University of Education, Singaraja, ID

E-mail: tya.ewie@gmail.com[1], rasben.dantes@undiksha.ac.id[2], gindrawan@undiksha.ac.id[3]

**Abstrack.** E-Report is developed based on the web to make it easier in preparing students' assessment reports in the form of rating reports, competency achievement reports, and ledgers. Even, many high schools/vocational schools in Bali have not implemented the E-Report. Implementation of cognitive walkthrough techniques, heuristic evaluation, and users' experience questionnaire in this research aimed to find out the results of evaluating user experience from the aspects of effectiveness, efficiency, user satisfaction, and recommendations for improvement. Effectiveness and efficiency were calculated by Cognitive Walkthrough techniques (CW), user satisfaction by user experience questionnaire techniques (UEQ) and recommendations for improvement, obtained from experts who discuss aspects of usability with Heuristic Evaluation techniques and Cognitive Walkthrough data. Based on the results obtained in terms of users, E-Report has been ineffective and inefficient. While in terms of user satisfaction, respondents were satisfied with Applications E-Report. This is because the effectiveness of a task that has a very large error and failure in one of the features as well as the clarity of results that poor user satisfaction can affect processing time. Therefore, evaluation of user experience based on aspects of usability in the E-Report has not met the criteria for products with good usability. Improvements made on the start page, page values, page value results were done through a photo frame. Therefore, identifying the problems from these three sources can further optimize the usability and improve user experience on E-Report.

## 1. Introduction

Authentic assessment method makes the format of student's report of curriculum 2013 more complex and detailed when compared to the students' report in curriculum 2006. Therefore, the Ministry of Education and Culture has developed an application of E-Report for vocational/senior and junior high school, which are directly integrated to the Fundamental Data of Education. E-Report application represents the application that is developed based on the web as a mean to simplify in compiling report of student assessment results in the form of rating reports, competency achievement reports, card reports, and ledgers. But in fact, there are still a lot of high/vocational schools in Bali, which haven't implemented E-Report application yet. According to fundamental data of middle and elementary education of Bali Province, for level of Junior and High school, there were only some schools in Bali that have started applying the e-Report, and there was while just one vocational school applied the E-Report from ministerial regulation (Permendikbud). Therefore, it is necessary to conduct the evaluation of user

experience to the E-Report application, focusing on its usability aspect, to evaluate whether the application of E-Report has been effective, efficient and give the satisfaction to its service.

User Experience is an understanding of somebody for using a product, system, or service. User Experience (UX) assesses how satisfied and comfortable a person is with a product, system, and service. As stated by Zidny, a good product will make the user understand right away with the display and also its process with the manual guide as minimum as possible [1]. To assess the user experience from a product, evaluation of the product needs to be conducted to determine its usability inspection and inquiry method. Usability inspection is used to evaluate the appearance of the E-Report application with cognitive walkthrough techniques and heuristic evaluation. Usability inquiry was used for system evaluation using evaluators or experts in their fields with questionnaire user experience (UEQ) techniques. The Cognitive Walkthrough (CW) technique is a usability evaluation method in which one or more evaluators work through a task scheme and ask questions from the user's perspective. The CW technique can help manage website designs that meet user requirements, manage parts of the design that cannot be understood by lecturers and students [2]. Heuristic Evaluation (HE) technique is a usability checking method to find usability problems in design for users to be present in part of the iterative design process, carried out using evaluators [3]. Questionnaire User Experience (UEQ) is a data processing tool related to user experience that is easily applied, trusted and valid, which can be used to complement data from other evaluation methods of good quality [4]. This technique can be used to measure UX. UEQ provides evaluation results consisting of quantitative data so that it is easier to process data.

CW is used to obtain data in the level of effectiveness and efficiency of the system. UEQ to obtain user satisfaction data, while recommendations for improvement are obtained from the problems of experts who understand the usability aspects with Heuristic Evaluation techniques and through the target prospective users of E-Report Applications sourced from Cognitive Walkthrough data. Cognitive Walkthrough and Heuristic Evaluation techniques have in common but are slightly structured and slightly directed [5] that is, evaluating usability on the user interface or user interface that focuses on the appearance of the system by means of experiments and investigations. However, the difference lies in the stage of collecting data from the results of experiments and investigations. Cognitive Walkthrough involved 20 respondents who have no experience in using e-Report applications, Heuristic Evaluation involved 3 expert evaluators or experts so that both of these techniques complement each other in evaluating the appearance of the system. Whereas the User Experience Questionnaire involved 130 users who have used the E-Report application. This study aims to determine the results of user experience evaluation on the E-Report application on the usability aspect by using cognitive walkthrough techniques, heuristic evaluation, user experience questionnaire (UEQ) and to know the recommendations for improvement on the E-ReportApplication based on the results of user experience evaluation analysis.

## 2. Research Method

Evaluation of User Experience in E-Report Application is evaluation research that produces qualitative and quantitative data so that the method used is a mixed method. Mixed-Method is a research method that combines quantitative methods with qualitative methods to be used together in research activity, to obtain more comprehensive, valid, reliable and objective data [6]. The research consisted of 6 (six) stages, namely:

1) Identification of Problem, the problem that happened is when several problems were found in the interface or system when the user try E-report application.
2) Literature Study, it was done by reading the related research through journal, article, paper, internet and reference book
3) Data Collecting, at this stage the required data were identified through discussions with evaluators and data retrieval using the Inspection method and the Investigation method. Data from the Inspection method were obtained from the results of cognitive walkthroughs and heuristic evaluations with sources from evaluator evaluations, while data from the Inquiry method were obtained from the results of the user experience questionnaire (UEQ) by the system user.

4) Data Analysis, in this phase, the data were analyzed following the mixed-method approach.
5) Recommendation for Improvement of E-Report Application, on this stage, the resut of the data analysis had come to a conclusion that were used as a reference to propose recommendation for interface improvement of E-Report application.
6) Making Wireframe, based on the result of the recommendation for interface improvement of E-Report application, a wireframe was then created.

In data collecting process, the technique of cognitive walkthrough consisted of two steps namely step of preparation and step of execution. Preparation step covers the literature study, learning system to be tested, determining responder and compile the duty scenario, which must be done by responder. Execution step covers the sequence of walkthrough action and problem recording based on the given scenario.

**Table 1**. Task Scenario.

| No | Instructions |
|---|---|
| 1 | "Now you are in the first page of e-report application You wish immediately enter (login) to the system. What's next?" |
| 2 | "Now you have stepped into the especial page of e-report application and wish to add or change lesson competency data which you teach." |
| 3 | "You return to dashboard. Now You wish to add or alter one part of Assessment Plan that is Knowledge Assessment Plan." |
| 4 | "Still in plan page, the Assessment Plan, now You wish to add or alter. Select KB/item of Spiritual Attitude." |
| 5 | "You return to dashboard. Now You wish to add or alter one part of scoring data input." |
| 6 | "You return to dashboard. Now You wish to add or alter the Students' description process." |
| 7 | "You return to dashboard. Now You wish to step into the page, look scoring process" |
| 8 | "You return to dashboard. Now You wish to step into the page look Final Scoring." |
| 9 | "You return to dashboard. Now You wish to step into the page Send the Scoring." |
| 10 | "You return to dashboard. Now You wish to step into the page Scoring Process result." |

In the heuristic evaluation technique, the instrument used by the evaluator to test the system is based on 10 Nielsen's heuristic principles, namely: visibility of system status, user control and freedom, 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 and help and documentation[7]. The data collection steps are as follows.

a. Training, evaluator evaluated the principal list of heuristic to ensure that they comprehended the principles
b. Evaluation, evaluator used the principle of heuristic to identify and describes problems individually. The used guidance to conduct the heuristic evaluation is ten principles of heuristic by Nielsen.
c. Rating, the evaluator conducted the problem ranking based on Severity Rating to the problem found. The task of Evaluator at this phase was to specify the Severity Ratings based on Nielsen'S Severity Ratings.

**Tabel 2.** Nielsen's Saverity Ratings.

| ***Severity Ratings*** | |
|---|---|
| **Rating** | **Definition** |
| 0 | *Don't Agree* |
| 1 | *Cosmetic Problem* |
| 2 | *Minor Usability Problem* |
| 3 | *Major Usability Problem* |
| 4 | *Usability Catasthrope* |

d. Debriefing, evaluators gathered to discuss what they find, giving recommendation and eliminating the double problems. To avoid the long problems list, then 10 problems were selected based on severity rating.

Questionnaire filling technique of User Experience Questionnaire (UEQ) was used to measure the value of satisfaction and consumer experience to E-Report Application in terms of Attractiveness, Clarity, Efficiency, Satisfaction, Stimulation, and Novelty with 26 items/attributes. The questionnaires were given to the responders who had used E-Report application. The purpose of UEQ is to compare the level of user experience between two products, test the user experience of a product, and determine the area of improvement. UEQ uses a semantic differential measurement scale that is almost similar to the Linkert scale, which is used to measure the attitudes, opinions, and perceptions of a person or group of people about social phenomena [8]. The final results from UEQ are illustrated in a benchmark graph showing the quality of products into five categories. The questionnaires were given to respondents who had used the E-Report application.

## 3. Result and Discussion

The obtained data from the process of usability inspection with the technique of Cognitive Walkthrough were data of time for working on assignments, the sum up of the failures, and input from the form of conclusion and suggestion given by responders while doing the assignments. For data about time, tasks performed and the number of failures (errors) obtained from 20 respondents or evaluators in the E-Report Application can be seen in Table 3 and Table 4. Table 3 shows the turnaround time of every task by each skilled and beginner responder to the teacher page while Tables 4 diplays the finishing time of every task on class teacher page. T1 until T10 represent the task 1 up to task 10 which were done by participants according to the scenario of the task. Workmanship time of every task was counted by set of miles seconds (ms) according to the analysis of record video of usability inspection evaluator. If error happened, it means that the participants failed to finish the task.

**Table 3.** Processing Time Skilled Responder and Beginner of Teacher Page.

| CODE | T1 | T2 | T3 | T4 | T5 | T6 | T7 | T8 | T9 | T10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **PGM1** | 1740 | 2340 | 2400 | 2460 | 2520 | 2820 | 2940 | 3060 | 3180 | 3300 |
| **PGM2** | 7620 | 13140 | 13440 | 13680 | 13740 | 14100 | 14240 | 14460 | 14640 | 15000 |
| **PGM3** | 1920 | 1980 | 2340 | 2820 | 3000 | 6300 | 7080 | 7260 | 7320 | 7440 |
| **PGM4** | 2160 | 3480 | 6000 | 6240 | 6540 | 6840 | 7020 | 7140 | 7200 | 7320 |
| **PGM5** | 1920 | 2760 | 2880 | 3000 | 6240 | 7200 | 7800 | *Error* | 8280 | 9000 |
| **Average skilled** | **3072.0** | **4740.0** | **5412.0** | **5640.0** | **6408.0** | **7452.0** | **7816.0** | **7980.0** | **8124.0** | **8412.0** |
| **PGP1** | 8640 | 26280 | 50760 | 51420 | 54540 | 55200 | 56340 | *Error* | *Error* | 56580 |
| **PGP2** | 8640 | *Error* | 12840 | 13980 | 14880 | *Error* | 18360 | *Error* | 19380 | 21300 |
| **PGP3** | 8220 | 8340 | 13140 | 14520 | 19080 | *Error* | 19560 | *Error* | 19620 | 19860 |
| **PGP4** | 8100 | 8880 | 14880 | 19140 | 19680 | 24000 | 24060 | *Error* | *Error* | 24120 |
| **PGP5** | 12720 | *Error* | 14820 | 21180 | 24240 | 24780 | 25680 | *Error* | 26100 | 26700 |
| **Average beginner** | **9264.0** | **14232.0** | **22788.0** | **28360.0** | **26484.0** | **34660.0** | **28800.0** | ***Error*** | **21700.0** | **29712.0** |

**Table 4.** Processing Time Skilled Responder and Beginner of Class Teacher Page.

| CODE | T1 | T2 | T3 | T4 | T5 | T6 | T7 | T8 | T9 | T10 |
|---|---|---|---|---|---|---|---|---|---|---|
| **PWM1** | 1004 | 10472 | 1140 | 1420 | 1610 | *Error* | 1400 | 8260 | 8075 | 2221 |
| **PWM2** | 1211 | 1345 | 2450 | 1486 | 2430 | *Error* | 1730 | 1240 | 2340 | 2151 |
| **PWM3** | 1511 | 1470 | 8121 | 3813 | 1630 | *Error* | 8241 | 9220 | 5420 | 1281 |
| **PWM4** | 1340 | 1291 | 2182 | 1934 | 4240 | *Error* | 1815 | 7180 | 4440 | 4238 |
| **PWM5** | 2181 | 1480 | 1320 | 4550 | 2380 | *Error* | 2430 | 2780 | 3801 | 2480 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Average skilled** | **1449.4** | **3211.6** | **3042.6** | **2640.6** | **2458** | ***Error*** | **3123.2** | **5736** | **4815.2** | **2474.2** |
| **PWP1** | 1113 | 14565 | 3220 | 106324 | 30203 | *Error* | 89877 | 14510 | *Error* | 13554 |
| **PWP2** | 3230 | 7120 | *Error* | 39150 | 32201 | *Error* | *Error* | 47202 | 31540 | 14167 |
| **PWP3** | 1335 | 33020 | 10302 | 124590 | 12380 | *Error* | 47090 | 19350 | 9220 | 22140 |
| **PWP4** | 2009 | 3021 | 2328 | 24030 | 14188 | *Error* | 19350 | 13024 | 8253 | 13240 |
| **PWP5** | 1278 | 6308 | *Error* | 12380 | 89874 | *Error* | 14510 | 19245 | *Error* | 30860 |
| **Average beginner** | **1793** | **12806.8** | **5283.333** | **61294.8** | **35769.2** | ***Error*** | **42706.75** | **22666.2** | **16337.67** | **18792.2** |

Time which is gone through by all responders were different each other. It is because of some natural constraint of the responders during finishing the task. The analysis of heuristic evaluation was done by 3 evaluators and 21 problems were identified. It means Evaluator gave the rating 2-4 for every identified problem. Frequency of Severity rating given by evaluator is shown in Figure 1.

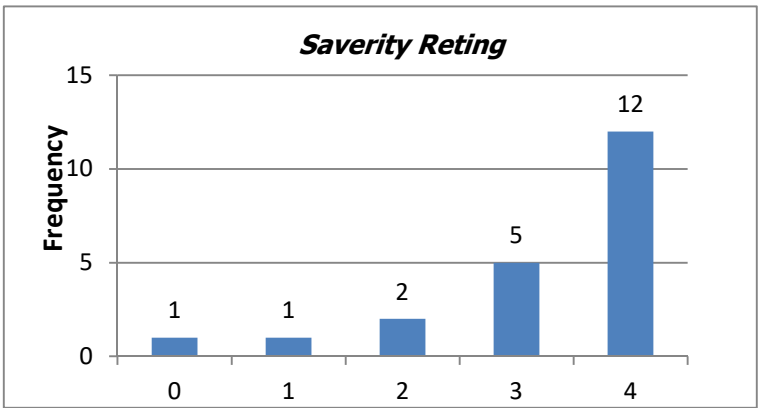


**Figure 1.** Graph of Frequency Severity Rating in E-Report Application.

According to the figure above, we can see that finding problems occured at the highest severity rating (4) namely 12 problems. This thing that the problems of e-report application have to be repaired immediately before the newest version product is released. While data obtained from the questionnaire UEQ (User Experience Questionnaire) represented result from the users' experience of E-Report Application were measured through six aspects namely: attractiveness, clarity, efficiency, accuracy, stimulation, and novelty. The questionnaires were filled by 130 senior high school teachers consisted of Subject Teachers, Guidance and counseling Teachers, and also Class Teachers.

At UEQ of Data Analysis Tool, average score from each aspect has been attributed to existing data set in the benchmark and it was used to measure the specified scale. The result from the benchmark can describe the relative quality of E-Report compared to other products shown in Table 5 and the graph of benchmark shown in Figure 2.

**Table 5**. Benchmark Result of E-Report Application.

| Scale | Mean | Comparisson to benchmark |
|---|---|---|
| **Attractiveness** | 1.64 | **Good** |
| **Clarity** | 1.38 | **Above Average** |
| **Efficiency** | 1.73 | **Good** |
| **Accuracy** | 1.48 | **Good** |
| **Stimulation** | 1.66 | **Excellent** |
| **Novelty** | 1.41 | **Excellent** |

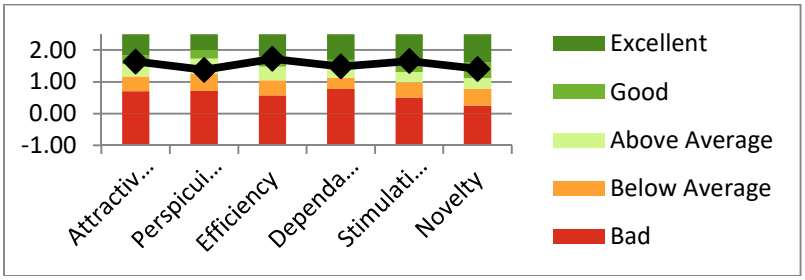


**Figure 2.** The graph of *Benchmark Result* E-Report Application.

From the description above, E-Report Application can provide the stimulation, novelty, accuracy, and convenience for its users. Besides, E-Report Application was said to be efficient by the user who had used the application since it did not take a long time in making e- report application. But from its clarity, the value aspect is above average so improvements at some parts are still needed.

The interface improvement of E-Report Application user was done by making wireframe. The guidance to make the improvement recommendation was based on ten heuristic principles from Nielsen and also the conclusion and suggestion were drawn by using Task scenario from cognitive walkthrough. Recommendations for improvement in this study were focused more on the ten problems that must be fixed immediately provided in the evaluation of heuristic and cognitive steps.

## 4. Conslusions

Based on the result of this study about the user experience evaluation of E-Report application using *the Cognitive Walkthrough* (CW), *Heuristic Evaluation* (HE) and User *Experience Questionnaire* (UEQ), it can be concluded as follows.

a. Effectiveness was measured by counting the sum of *error* which happened during the participants finishing the task. The results obtained through *Cognitive Walktthrough technique* showed large of error percentage which happened on teacher page. The error percentage was equal to 2% expert group and 22% beginner group. While on class teacher, the error percentage happened at expert group was equal to 0,1% and at beginner group was equal to 20%. Seen from the average percentage as a whole, E-Report application might possibly effective because it was not exceeding 68%. But because we get the task owning very big error percentage that is 100% on task 8 at beginner group on teacher page and task 6 at expert group and beginner on class teacher page indicating there is a unsuccessful fitur of the system run its function. Hence, it is concluded that there were usability problems of E-Report application which taken as research object. Therefore E-Report application from user side can be said not effective yet.
b. Measurement of the efficiency from the result of usability of E-Report application was done through comparing time needed by an expert group responder with the time needed by a beginner group in doing task using method of Mann Whitney U-Test. The data resulted from Cognitive Walkthrough showed the p value of the teacher data was greater than score  which has 0.05. Therefore, statistically, time on doing the task for the beginner users almost the same significantly with the expert users, though the mean rank for the expert group is smaller than it. If overall task was combined, there were 20 tasks namely 10 tasks for the teacher and 10 for the class teacher responder. From the explanation above, a conclusion can be drawn that there were 8 tasks that can be considered to pose no significant difference. 12 other tasks posed the significant difference at time on doing the task between expert and beginner group although workmanship time of expert group is a little bit quicker than the beginner responder. From this conclusion, it can be decided that E-Report Application has not efficient yet. It is because the responders used E-Report Application for the first time. An application can be considered efficient if the users have often used E-Report and accessed the internet.
c. User satisfaction was obtained from the result of user experience during using E-Report application. The sixth average value aspect of user experience was positive with the belief value about 0,167

attractiveness aspect. This matter indicates that the value of user experience of attractiveness aspect range from 1,477 until 1,810. Based on the result of comparison of application E-Report with the other product on the benchmark, the research obtained 3 categories Good from E-Report Application namely attractiveness aspect, efficiency, and accuracy. The category has meaning 10% product in better dataset and 75% worse on other product. Excellent category from E-Report Application was on aspect of stimulation and novelty. This matter indicates that E-Report Application on stimulation and novelty are included in gyration 10% best result. While clarity aspect from E-Report Application was in category of Above Average which means that 25% product on a dataset is better compared than E-Report application meanwhile, 50% is worse. Based on the explanation, it can be stated that E-Report application can provide stimulation, novelty, accuracy, and convenient for user. Beside that, E-Report application can be stated efficient by user who has ever used the application since it does not need a long time in making report card. But, from its clarity, the value aspect is above average so that the improvement of some parts is still needed. Therefore, it can be concluded that the responder is satisfied with E-Report Application.

d. The result of the user experience evaluation process on the usability aspect is that the E-Report application as the object of research did not meet the product criteria with good usability. Because, at the level of effectiveness, there was a task that has a very large percentage of errors that is 100% in task 8 in the beginner group on the teacher's page and task 6 in the advanced and beginner group on the homeroom page which indicates there is a feature in the system that fails to function. From the feature and poor clarity of the results of user, satisfaction can affect the time of user workmanship. Therefore, there were 12 other tasks that have a significant difference in the time spent on skilled task groups and beginner groups which cause the E-Report Application to be inefficient. Therefore, the E-Report Application cannot meet the good criteria for all three aspects.
e. Improvement Recommendation. In this research, improvement recommendation was focussed to alter the layout of page, add the navigation or guidance, add to search, eliminate the undo and redo, error message notification, language, documentation and also syntax program which possible become the error causes to the user. Improvement was done by making wireframe of homepage, assessment page, and assessment result page. Improvement was done by using technique of Heuristic Evaluation and Cognitive Walkthrough since it can find a group of problems exist in E-Report Application where the problem influenced the aspect of user experience. Beside that, the problems did not only occur from the expert comprehending aspect usability, but also found through potential users of E-Report Application which are sourced from data of Cognitive Walkthrough. Thereby, the focusing of problems between three sources can be more optimal to the usability side and also improve user experience to E-Report Application.

## 5. Recommendations for future research

On the suggestions, there are some things that can be a consideration to follow up.

1) It is better to socialize the usage of E-Report Application to the user which less understands the way of using E-Report Application for more helping the user of E-Report Application
2) Template or design should be adjusted to make E-Report Application looking attractive
3) For the next research, it is necessary to conduct a measurement to the learnability aspect (habit visits a system) and memorability (catchy) on other systems so that the result of research more detail concerning other relevant indicators.

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