Evaluation and implementation of cognitive ergonomics in e-wallet redesign to reduce experience effort of e-wallet user

Desica Nur Adimia, Billy Muhamad Iqbal, Danu Hadi Syaifullah, Ahmad Syahid Zakaria
Department of Industrial Engineering, Universitas Indonesia
E-mail: desica.nur@ui.ac.id, billy.iqbal@eng.ui.ac.id, danuhadi@ui.ac.id, ahmad.syahid@ui.ac.id

Abstract. Communication technology in Indonesia is growing rapidly and has an impact on the changing behaviour of Indonesian people, which makes industrial sectors use technology as the value of its products. One example of industry that use technology as the value of its product is payment gateway. It is also supported by Indonesia which is now entering the cashless era. E-wallet is one of payment gateway product that has the potential to be a product of the ideal payment. E-wallet is an electronic wallet that is basically a part of server-based electronic money. However, its current use is still not much demanded by the public because e-wallet products that currently use by most people are difficult and require big effort in its use. Whereas as a product which adopt a “wallet” concept, e-wallet should be equipped with the experience of using a physical wallet those are low-effort experience and ease of use. Therefore, this study aims to evaluate mobile e-wallet application by measuring cognitive load resources and evaluating user experience of e-wallet, then providing new design output that comes with the experience of using physical / conventional wallets and more user oriented. Evaluation was performed on e-wallet application object, namely OVO Wallet, with performance metrics and self-reported metrics measurement. The results of these evaluations will serve as the basis for designing new designs of e-wallet products.

1. Introduction

The development of communication technology today has a great impact for many aspects, one of them is in the industrial sector. The inclusion of the digital era caused a major change in behaviour, habitat, and interaction in humans. Based on statistics from the Association of Internet Service Providers Indonesia (APJII), the number of internet users in Indonesia in 2016 reached 132.7 million or 51.8% of the total population in Indonesia. The changing in human behaviour that it quietly significant in this era, making the company eventually use technology as a value of its product. One example of industry that uses technology in it is the payment gateway which is an industry engaged in electronic money and online payment services. Increased infrastructure that receives non-cash payments in Indonesia shows that Indonesia is in the category of countries that are in the early stages of entering the cashless era, because although it still got a few of adoption, non-cash transactions in Indonesia have increased sharply since several years ago. This is a great opportunity for products that move in the payment gateway industry, with one of its products that has the potential to become the product of payment gateway ideal for the public is e-wallet. E-wallet or electronic wallet is basically a part of server-based e-money with online and offline usage. As a product that equally themed a wallet,
e-wallet should be equipped with experience from the use of conventional wallets that is low-effort experience and ease of use. However, in Indonesia, the increase in online transactions conducted by internet users is not aligned with the increase in e-wallet users. E-wallet products are growing in Indonesia today still has big effort experience. Based on survey results from JAKPAT- Mobile Survey Platform Indonesia, from 1,515 respondents who are samples from Indonesian population, 44% are users of digital wallet with 69% of them using e-wallet only 1-3 times a month. This shows the lack of experience and the use of e-wallet. Internet penetration in Indonesia is high, but the use of digital wallet is still small. A lack of understanding of the use of services is a major obstacle to the lack of e-wallet use. In fact, by providing low-effort experience, ease of use, and maintained the attractiveness of e-wallet application, e-wallet can have better user experience and usability so as to improve user productivity of e-wallet products. This is supported by the advantages of product usability that can increase productivity and efficiency [1]. Therefore, to improve user from e-wallet, it is necessary to understand and trace back user experience from e-wallet application product to make it easier for user in transact so that user have low-effort experience in transaction and it can increase user from user e-wallet. This study aims to evaluate mobile e-wallet applications by evaluating user perceived experiences, then providing new design outputs that are equipped with the experience of using physical/ conventional wallets and more user oriented.

2. Methodology

In this research, e-wallet object to be studied is OVO application, which is application of one of Top 10 e-wallet application in Indonesia. The evaluation is a summative evaluation, in which the evaluation aims to evaluate products that have entered the market. In evaluating OVO Wallet, researchers determine the dimensions of the user experience to be assessed and evaluated. The dimensions of user experience were selected through literature studies through a book entitled Measuring the User Experience 2nd Edition, and several research journals related to usability testing and UX evaluation. Here are the stages of evaluation conducted by researchers.

1. Test of user experience measurement of OVO application, data will be processed to see if there is any influence of user experience on usage of e-wallet application. Dimensions to be taken are stated on Tabel 1.

| Table 1. Performance Metrics Dimension |
|----------------------------------------|
| **Metrics** | **Measurement Tools** |
| Task Success | Binary Success, which 1 means success and 0 means failed |
| Time on Task | Time for task completion |
| Efficiency | Lost-ness: compare the number of visited interfaces with the optimal number of interfaces |
| Errors | The number of errors in the step or sub-process performed |

2. Problem discovery, at this stage the user perceptions are taken as a whole on the interaction with the system and continues to identify usability problems in the e-wallet application.

| Table 2. Metrics for Qualitative Data |
|----------------------------------------|
| **Metrics** | **Measurement Tools** |
| Self-Reported Metrics | SEQ, QUIS, AttrakDiff |
| Issue-Based Metrics | Retrospective Think Aloud |
Technically, data retrieval is done by asking respondents to use OVO application. Respondents in this study must meet the criteria of being in the age range of 20-25 years and have been using mobile wallet / e-wallet to avoid possible bias in the research process. Respondents were divided into two groups: the experienced respondents who are the user of OVO and the group of inexperience respondents who never used OVO. Grouping is done to see the effect of the user experience on the use of the OVO app. Here is the sequence of data collection process:

a. Introduction where researcher explained the process and respondent fill out general question, then they were asked to explore the OVO application.

b. Respondents started taking data on each task after the start command provided by the researcher, while performing tasks, respondents paired the TobiiPro Eye Tracker tool. During data retrieval, the respondent will be recorded via a mobile phone.

c. The finish time for each task counted if respondent completed the task or respondent give up to completed the task.

d. After taking performance metrics data, respondents were asked to fill out a SEQ, QUIS, and AttrakDiff Questionnaire

e. The latest data retrieval is issue-based metrics with retrospective think-aloud method by displaying respective video record of each respondents.

There will be 5 task scenarios that respondent will do. The details of the scenarios will be stated on Table 3.

| Task | Measurement Tools |
|------|-------------------|
| 1    | Fill the mobile phone credit |
| 2    | Buy food vouchers with a maximum price of Rp 30,000 |
| 3    | Get OVO Points at the time of payment in offline retail by raising the barcode ID that is in the OVO application |
| 4    | Transfer of 10,000 balance to OVO account |
| 5    | Top up credit balance |

A product that has a low effort experience is a product where users can complete a goal on a product with minimum time, effort, and error, and the product can be quickly learned without extensive training or help [2]. In this case it is related to perceived ease of use. Therefore, in this evaluation the hypothesis taken by the researcher is the absence of significant difference between the two groups of respondents.

3. Result and Discussion

In this part will be presented and discussed the results and discussion of this research data processing. The data that presented will be the result from quantitative and qualitative data that shown the comparison of tasks completion performance from both groups of respondent. The discussion will be about OVO Wallet evaluation based on verbal interviews and eye tracking data.

3.1. Quantitative and Qualitative Data

Quantitative data will be gathered from the result of task Success, time on task, efficiency, and errors [3]. Meanwhile, qualitative data will be gathered from Single-Ease Questionnaire, Questionnaire for User Interface Satisfaction, and AttrakDiff. Based on quantitative result, can be concluded that experience is significantly affect the performance in task completion. In qualitative result, can be concluded that both groups of respondent have similar difficulties in performing tasks and Screen, Terminology and System Information, and Learning are the main problem in the applications. Summary of data results can be seen in table 4.
Table 4. Questionnaire for User Interface Satisfaction Result

| Metrics              | Result                                                                 | Conclusion                                                                 |
|----------------------|----------------------------------------------------------------------|---------------------------------------------------------------------------|
| **Quantitative Data**|                                                                      |                                                                           |
| 1 Task Success       | Both respondent groups 100% able to complete all the tasks           | There is no significant effect of experience on the success rate           |
| 2 Time on Task       | Less time needed from experienced respondents to complete tasks 1,2,4,5. (significantly different) | There is a significant effect of experience on the time required respondents to complete tasks |
| 3 Efficiency         | Experienced respondents have smaller lost-ness value than the group of inexperienced respondents. | Experience affects the number of errors generated by users in using OVO Wallet |
| 4 Errors             | Experienced respondents have less number of errors in complete task 1,3,4,5 (significantly different) |                                                                           |
| **Qualitative Data** |                                                                      |                                                                           |
| 5 Single-Ease Question | There is insignificant difference between both of groups on all tasks (except task 1). Overall, the average score for each task has not reached 4 (parameter of good usability) | Both groups of respondents still find it difficult to achieve goals in the task. |
| 6 Questionnaire for User Interface Satisfaction | Screen, Terminology and System Information, and Learning is the categories needed to be improved |                                                                           |
| 7 AttrakDiff         | The lowest score in the assessment of attribute is pragmatic qualities which indicates that this application has lack of ease and usability |                                                                           |

3.2. Respondent Interview and Eye-Tracking Result

Based on issue-based metrics from verbal interview with respondents, using pareto diagram, founded 80% problems commonly founded in visualization and layout of the OVO application. In this part will be discussed the analysis of each task to identify the cause of the error and the length of time the respondent while working on each task requested. This analysis is based on interviews with respondents through Retrospective Think Aloud protocol, data processing of design elements, and heat-map obtained from eye-tracker. The results of this analysis will be the reference for designing a new interface design for the e-wallet application that is OVO Wallet.

In Task 1, from the heat-map of the homepage interface (Figure 1&2), the visual pattern from inexperienced group is scattered in two parts: the balance bar section and the top menu, but they are more focused on the button of the deal. They feel that they are not capturing information about the purchase of the pulses contained in the pay bill icon button. Meanwhile the focus pattern of the experienced group is spread evenly in two parts, namely the balance bar section and the bottom menu. They argue that the icon button on the bottom menu is not easy to remember so it takes time to recall the icon button for top-up. In the heat-map of the e-form interface of pulse top-up (Figure 3), both groups of respondents aren’t aware of the contact button icon to go to the list of existing numbers on the contact.
In Task 2, from the heat-map of the homepage interface (Figure 4&5), the visual pattern from inexperienced group spreads with focus on the lower menu. This group of respondents searched all over the entire page. They argue that the button deals provide less information that the icon is for the purchase of the voucher. Meanwhile experienced group visual patterns are spreading, but their full focus is on the button of the deal. The experienced group argue that to get to the button deals is not too difficult but it's good that the purchase is placed on the same menu.

In the heat-map of deals interface (Figure 6&7), the visual pattern from inexperienced group spreads as they are new in this view so it searches almost at all parts. But their focus is directly on the Deals & Promo section. According to them, the overall interface is quite confusing and they cannot understand the difference of deals and promos. Meanwhile, experienced groups don’t have a spreading visual pattern because they already know the location of categories on this interface.
The visual pattern of both groups of respondents is the same on the voucher list interface (Figure 8), the time spent on the interface of vouchers list from both groups are very long. Both groups find it difficult to do voucher search because there is no sort feature (sorting). In task 3, based on heat-map results on the homepage (Figure 9), respondents see the most on the barcode scans, while the barcode button at the bottom of the interface is not seen at all. Through RTA, all activities in barcode-related applications (barcode scans or barcode scans) are placed on the same icon button.

In task 4, the visual pattern on the e-form transfer interface (Figure 10) tends to spread but the respondent's attention isn't go to the nominal charge bar. Through RTA, both groups of respondent said that the nominal charge bar is difficult to find at the beginning of viewing the e-form transfer interface. The nominal bar shape is not like a fillable bar, so it takes a long time to find the bar where the nominal filling you want to transfer to your OVO Wallet account.

3.3. Redesign Phase

The results of the evaluation show that the user interface OVO Wallet application still provides a less good experience for users. Thus, the purpose of designing the user interface OVO Wallet application is to provide a better user experience to users.

In designing the user interface of the e-wallet application, researchers designed user interfaces that provide ease of use so that users have low-effort experience in using e-wallet. This is done by designing the user interface with elements that are capable of providing cognitive affordance in accordance with its function, so that its use is easily understood by the user. In addition, the design of the user interface is done so that UI can provide experience using conventional wallets. As we know by definition, mobile wallet should be a mobile application that can support users experience similar to the experience of using a conventional wallet.

There are components that must be considered in designing the user interface of the e-wallet application. Previous research [4] has suggested important components that must exist in e-wallet applications. In this study, we have components that have been adapted to the components of previous research, and will be considered in the design of the OVO Wallet user interface. These components, among others,

1. Home, is a preliminary view of choice of features and initial information
2. Account, is a feature that contains user information
3. Balance, is the display of the amount of money we have on the application
4. History, is a feature that contains all the transactions we have done
5. Transfer, is a feature to send money to another account
6. Top-up, is a feature to add balance
7. Purchase and payment, is a feature to make a purchase

The components are determined for its importance by Activity Relationship Chart method [5]. The result will be used as based for user interface redesign. The ARC will be shown in figure 11. Next is the redesigning phase, the design of the user interface is done by the method of cognitive walkthrough method, where the researcher performs a design that starts from making some static wireframe of the analyzed interface must be redesigned. The design idea was obtained based on the discussion with the users of e-wallet, the result of literature study and benchmark to similar applications such as Alipay, Sakuku, etc. Here are the results of designing on some of the interfaces of the OVO on figure 12.

![Activity Relationship Chart](image1)

**Figure 11. Activity Relationship Chart**

![User Interface Redesign of OVO App](image2)

**Figure 12. User Interface Redesign of OVO App**

### 3.4. Redesign Verification

The design improvement verification test is conducted to see the effect of the new design on the level of ease of use and attractiveness provided to give the low effort experience for its users. The design to be tested shaped prototype application of the new interface design results. The tests that will be performed are performance metrics (time on task and lost-ness) and self-reported metrics (Questionnaire of User Interface Satisfaction and AttrakDiff). Those are done to see if there’s any significant changes occur that represent changes in the level of ease of use and attractiveness with the new design. The result from time on task shown that the average time completed decrease by 53%
(from inexperienced respondents) and 38% (from experienced respondents). From lost-ness result, shown that the efficiency increased by 81% (from inexperienced respondents) and 58% (from experienced respondents). From AttrakDiff result, shown that the average AttrakDiff score from both group of respondents are increase by 40%. From QUIS result, shown that the average QUIS score from both group of respondents are increase by 38%.

The results from performance metrics shown that new interface user interface design has a higher efficiency than the old user interface design. Efficiency itself refers to how much effort is given to complete the task. The result from self-reported metrics shown that have higher level of attractiveness and satisfaction in the new user interface design than the old user interface design.

4. Conclusion

1. Evaluation of the user experience of the e-wallet application is done by measuring performance metrics, self-reported metrics, and issue-base metrics.

2. Based on the results of performance metrics evaluation, the performance between inexperienced group and experienced group of respondents is significantly different. This implicated that experience affect significantly from the use of e-wallet.

3. Based on the results of self-reported metrics and issue-based metrics evaluation, the assessment from both groups of respondents are insignificantly different. Results of interviews with the RTA protocol found that users have difficulties and less satisfaction when using e-wallet.

4. Designed a new user interface capable of supporting low-effort experience to users based on the results of the evaluation conducted on the e-wallet application that is OVO Wallet.

5. Based on the new design verification, new UI design is able to provide low-effort experience and ease of use to its users, also with the increasing of attractiveness and satisfaction.

References

[1] Donahue, G.M 2001 Software, IEEE vol 18 p 31-37

[2] D. A. Norman 2002 The Design of Everyday Things. New York: Basic Books, Inc.

[3] B. Albert and T. Tullis 2008 Measuring the User Experience San Francisco, CA, USA: Morgan Kaufmann Publishers Inc.

[4] M. Olsen, J. Hedman, and R. Vatrapu 2012 Designing digital payment artifacts Proc. 14th Annu. Int. Conf. Electron. Commer. - ICEC ’12 p 161–168

[5] F. Muhammad, N. Faradilla, E. Muslim, and D. N. Adimia 2017 User experience evaluation on the usage of commuter line train ticket vending machine 6th Int. Conf. Ind. Technol. Manag. ICITM 2017 p 164–170

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