Usability Analysis of the IBOSS PTSP BP Batam User Interface Using Heuristic Evaluation

Bintang Febrian Alamandha[1], Rina Yulius[2]

[1,2]Informatics Departement, Politeknik Negeri Batam, Batam, Indonesia
Email: [1]4312001089.MJ@students.polibatam.ac.id, [2]rinayulius@polibatam.ac.id

Abstract

This research investigates user dissatisfaction with the IBOSS user interface, reported by 54% of users in an initial survey, and aims to improve the interface through heuristic evaluation and subsequent redesign using Gestalt principles. The usability of the IBOSS user interface was assessed using the heuristic evaluation method, focusing on 10 usability variables. Among the 10 heuristic variables, only the 'Aesthetics and Minimalist Design' variable was rated positively, with a score of 78% and was considered satisfactory with no need for improvement. Based on the evaluation results, the interface was redesigned using Gestalt principles to improve user experience. After the redesign, interviews with experts showed a significant improvement in the user interface. The experts gave positive feedback compared to their assessment before the redesign. The heuristic evaluation identified key areas for improvement in the IBOSS user interface, excluding aesthetic aspects. Applying Gestalt principles in the redesign process resulted in improved usability and received favourable feedback from experts, indicating the success of the redesign effort.

Keywords: User Interface, Heuristic Evaluation, Gestalt Principles, Usability, Interface Redesign.

1. INTRODUCTION

IBOSS (Indonesia Batam Online Single Submission) is an electronic business licence management website system owned by the Directorate of One-Stop Integrated Services of the Batam Concession Agency (PTSP BP Batam). IBOSS has an important role as the main means for business licence applicants to interact with the Directorate of One-Stop Integrated Services of the Batam Concession Agency (PTSP BP Batam) [1]. However, no usability testing has ever been conducted on the IBOSS to determine the quality of feasibility. In addition, there are several complaints submitted by IBOSS users that they feel dissatisfied in managing licences through the IBOSS.

Usability testing can be interpreted as a technique for testing and measuring software applications that refer to 5 aspects, namely, learnability, efficiency, memorability, errors, satisfaction [2]. A system is very necessary to do usability testing using clear standards to determine the condition of the system, usability testing often uses the heuristic evaluation method [3]. The importance of usability testing to measure the quality of the feasibility of a system that leads to several test methods, after usability testing is carried out on users, aspects that need to be improved are obtained, namely effectiveness and reducing the occurrence of errors [4].

Based on the results of an initial survey of 55 users who have processed business licences through IBOSS, it is known that 25 people (45.5%) of them expressed satisfaction, but there were 30 people (54.5%) who expressed dissatisfaction in using IBOSS. From the survey results, it is known that user dissatisfaction in using IBOSS is caused by several things such as, interface design that is less neat and has a confusing layout, the unavailability of IBOSS usage guides, and the use of language or terms that have not been known by previous users.

If the constraints on the user interface of the IBOSS are not immediately corrected, it will reduce the number of public trust and satisfaction with the performance of the services of the Directorate of One-Stop Integrated Services of the Batam Concession Agency (PTSP BP Batam) because the quality of its website feasibility does not meet the standards and will have an impact on the poor performance assessment of this directorate.

The method that will be used in usability analysis is Heuristic Evaluation and in user interface redesign will use Gestalt principles. One of the advantages of usability analysis using the heuristic evaluation method is that it produces a more specific list of errors [2]. In addition, in general, the heuristic evaluation method has the advantage that the evaluation process is easy, fast, and low cost [3]. The Gestalt principle is a principle that defines a vision process by grouping components that have patterns, similarities, and relationships into something solid [5]. This principle can provide a rational explanation of changes in spacing, timing, and configuration that can affect the information displayed [5]. Designing a user interface display with the Gestalt principle will create an attractive visual design and increase the ease of communication effectively to users, making it easier for users to understand the information [6].

This research was conducted to determine user satisfaction with the IBOSS by testing its usability using the heuristic evaluation method which will focus on 10 aspects of usability. Furthermore, the design of user interface design improvement of IBOSS using gestalt principles based on the usability test results that have been done. It is hoped that this research can be taken into consideration by BP Batam

in improving the IBOSS to improve service quality and increase user satisfaction with the services provided by BP Batam in managing business licences.

2. METHODS

There are two stages carried out, namely the usability analysis stage of the IBOSS user interface and the user interface redesign stage of the IBOSS .

2.1. Analysis

The stages of usability testing using the heuristic evaluation method in this research can be seen in Figure 1.
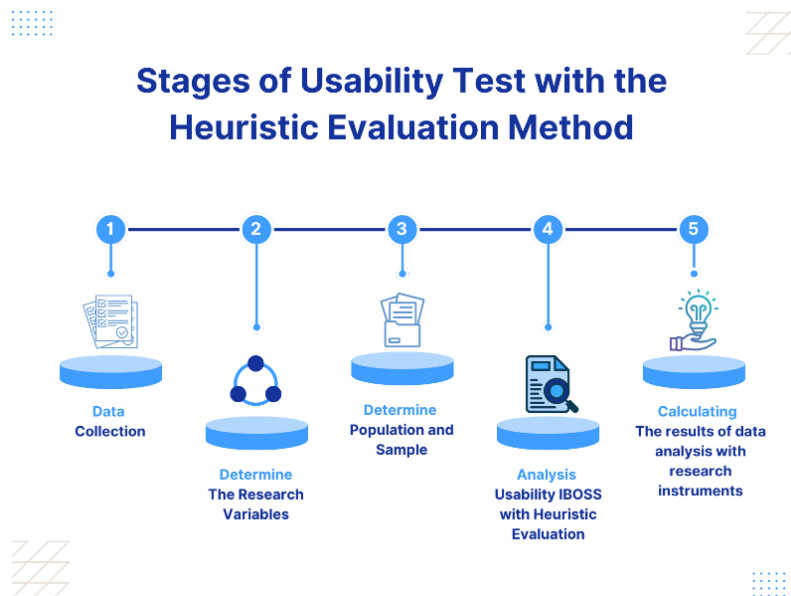

Figure 1. Stages of Usability Test

1) Data Collection

Data obtained from several sources, namely, literature studies, expert interviews in the field of UI/UX, and questionnaire surveys on IBOSS users.

2) Research Variables

In the analysis of usability user interface of IBOSS, there are 2 categories of variables. 10 principles of heuristic evaluation are included in the independent variable and usability is included in the dependent variable.

3) Population and Sample

The population taken is individual users of the IBOSS who entrepreneurs or company representatives are appointed to take care of the licensing of a company. The total population used was 55 users. The population is limited because it is limited by the Directorate of PTSP BP Batam. For sample selection using purposive sampling method. With this method the sample members are appointed intentionally because only those samples can represent to provide the necessary information [4]. According to [7] if the population used in the study is less than 100 then only 25% is determined to be the sample. Based on this opinion, in this study 25% of the population will be used as a sample. So, 25% of the total sample of this study are 14 users who will be sampled.

4) Analysis Usability Technique

Usability analysis in this study uses the usability framework proposed by Nielsen, namely Heuristic Evaluation.
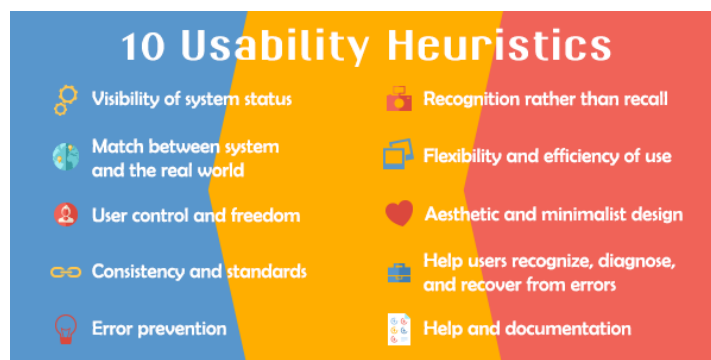

Figure 2. Heuristic Evaluation principle

Heuristic evaluation is a testing method that involves usability experts in assessing whether the elements contained in a website follow usability principles [3]. The problem identification assessment is carried out by comparing the product with 10 heuristic principles proposed by Nielsen [8].

Based on the above opinion, the analysis stage will involve 3 experts. This is in accordance with Nielsen's opinion, which states that the use of only 3 evaluators is satisfactory [3]. In addition, this stage will also involve 14 users who are samples in this study who will compare the website with 10 heuristic evaluation principles using a questionnaire survey as a representative of the population of IBOSS users.

The questionnaire data was analysed using descriptive statistical analysis which is data analysis by describing the data that has been collected without intending to

make general conclusions [9]. The use of these methods in this study aims to get the results of questionnaires in the form of percentages to determine the level of user interface design of the IBOSS based on heuristic evaluation analysis.

Data from interviews conducted with experts will be analysed using thematic analysis techniques. According to Braun & Clarke (2006) in [10] thematic analysis is a data analysis technique that aims to identify patterns and find themes from the data that has been collected. After the transcripts of the interview conversations were analysed, they were then implemented in the coding stage. Coding is the process of reviewing raw data by labelling the data in the form of words, phrases, or sentences [10].

5) Research Instruments

Data collection in this study was partly carried out with a questionnaire instrument. Questionnaire is a data collection technique carried out by distributing a list of questions in the form of a google form related to research to respondents [11]. This research questionnaire uses Likert scale variables to determine the questionnaire answers. Likert scale is a scale used to assess or measure an object or phenomenon [12]. However, there is a slight modification by eliminating the answer category in the middle. The goal is to get more accurate answers so that only 4 Likert scales are used [13]. Details of the score weights are in the Table 1.

Table 1. Likert scale score [13]

Statement	Score	%	Description
Very Agree (SS)	4	76% - 100%	Cosmetic (no need to fix)
Agree (S)	3	51% - 75%	Minor Usability (problem needs to be fixed but with low priority)
Not Agree (TS)	2	16% - 50%	Major Usability (problems urgently need to be fixed with high priority)
Very Not Agree (STS)	1	0% - 25%	Usability catastrophe (problems must be fixed immediately)

The formula used to calculate the Likert scale is using the following Equation 1 [14]:

$$K = T \times Pn \qquad (1)$$

Description: T = Total number of respondents on one statement, and Pn = Score of the available likert choice options. Score Breakdown of Pn as shown in Table 2.

Table 2. Score breakdown

(SS)	(S) = 3	(TS)	(STS)
4	3	2	1

The accumulated score on each statement is then calculated again to find the percentage value of the index. The formula used is as shown in Equation 2 [14].

$$Score\ Indeks\ (\%) = (KT\ /\ Y) * 100 \tag{2}$$

Description: KT = total number of K's from one statement, and Y = the number of respondents multiplied by the highest statement score. Next, find the score index interval (I) using the Equation 3 [14].

$$I = 100\ /\ sum\ of\ approval\ rates \tag{3}$$

2.2. Redesign Making

The redesign of the user interface of the IBOSS is carried out using the Gestalt principle. Gestalt is a principle that explains the process of perception by organising interconnected components [15]. This principle was discovered by three German psychologists Max Wetheimer, Kurt Koffka, and Wolfgang Kohler in 1920 [5].

The user interface redesign of IBOSS will apply five basic gestalt principles to improve communication with users so that information can be more easily understood [6]. The five Gestalt principles consist of proximity, similarity, continuity, figure and ground, and closure[16].

3.   RESULTS AND DISCUSSION

3.1 List of Expert Evaluators

The evaluator who conducts the evaluation is a combination of 3 experts who are considered to have competence in the field of UI/UX. According to Nielsen (1994) in [3] using 3 evaluators to evaluate is satisfactory and more practical as shown in Table 3.

Table 3. Expert evaluators profile

No	Kode	Area of Expertise/ Work
1.	Ev 1	UI/UX/ Digital Creative Program Manager Infinite Learning

No	Kode	Area of Expertise/ Work
2.	Ev 2	Full Stack Developer/ Web Developer Pemko Surabaya
3.	Ev 3	UI/UX, Front End/ Freelance Web Developer

3.2 Descriptive Analysis Results

In the evaluation conducted by the user, the severity rating is obtained which is then accumulated and the percentage is sought. The results of the percentage of saverity rating evaluation using heuristic variables are illustrated in the Table 4.

Table 4. Heuristic evaluation result

| Heuristic	(%)	Description
Visibility of System Status	61%	Minor usability
Match Between System and the Real World	63%	Minor usability
User Control and Freedom	56%	Minor usability
Consistency and Standards	65%	Minor usability
Error Prevention	58%	Minor usability
Recognition Rather than Recall	54%	Minor usability
Flexibility and Efficiency of Use	63%	Minor usability
Aesthetic and Minimalist Design	78%	Cosmetic
Helps User Recognize, Diagnose, and Recovers User	63%	Minor usability
Helps and Documentation	62%	Minor usability
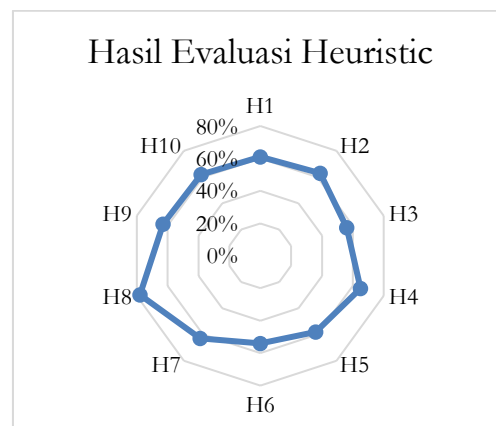
Figure 3. Heuristic evaluation result statistics

Based on the table and figure above, it can be seen that almost all Heuristic variables from the IBOSS website have values that fall into the minor usability

category, which means they are included in the category that needs to be improved but with low priority. There is one variable, namely H8, which gets the highest percentage value of 78% with the cosmetic category, which means that no improvement is needed on that variable.

3.3 Redesign of IBOSS Website User Interface Display

Based on the results of the analysis conducted by both users and experts, and by comparing the website with the 10 principles of heuristic evaluation, the following are the results of the user interface redesign of IBOSS, which is designed referring to the Gestalt principles. The user interface redesign of IBOSS is grounded in the application of five basic Gestalt principles: proximity, similarity, continuity, closure, and figure-ground. These principles guide the organization and visual perception of elements on the interface, enhancing usability and user experience.

Proximity Principle: This principle is evident in the placement of related elements close to each other, which helps users understand that these elements are connected. For instance, in Figure 4, the login fields are grouped closely together, making it clear that they belong to the same function.

Similarity Principle: Elements that share similar shapes are placed in proximity but differentiated by color to aid in their identification. This is applied in the login page redesign (Figure 4) where buttons such as 'submit' and 'cancel' are similarly shaped but use different colors (contrast for 'submit' and 'cancel'), making their functions immediately recognizable.
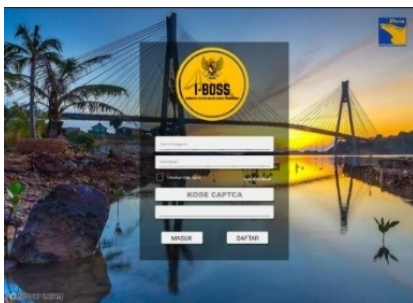

Figure 4. Log in page after redesign   **Figure 5.** Login page before redesign

Continuity Principle: This principle is utilized by aligning elements in a way that creates a smooth flow, making the interface easier to navigate. For example, in the redesigned option page (Figure 6), menu items are arranged in a straight line, guiding the user's eye along a clear path.

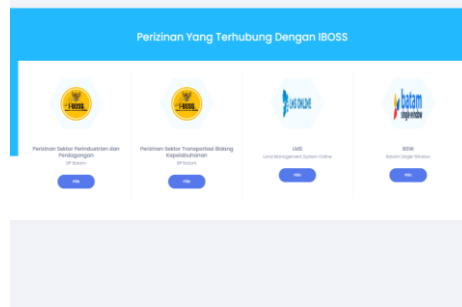**Figure 6.** Option page after redesign

Figure 7. Option page before redesign

Figure-Ground Principle: The most critical application is found in the website's extensive use of text and data entry fields. Proper background color selection ensures that text is easily readable, as shown in the redesigned profile page (Figure 8), where the contrast between the text and background is optimized for readability.

Closure Principle: Applied to icon design, this principle ensures that even when icons are not completely outlined, users can still recognize them. This is because the human mind tends to fill in missing information to perceive a complete shape. For instance, icons in the profile page redesign (Figure 8) are designed with partial outlines, yet they remain easily identifiable to users.
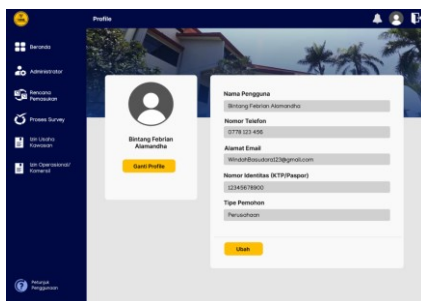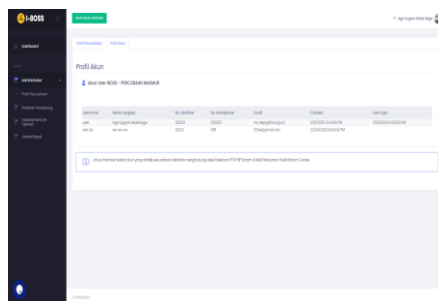

Figure 8. Profile page after redesign

Figure 9. Profile page before redesign

By employing these Gestalt principles, the redesigned IBOSS interface not only enhances aesthetic appeal but also significantly improves functionality and user satisfaction. The before and after comparisons (Figures 5, 7, and 9) clearly illustrate the improvements made in terms of layout, clarity, and overall user experience.

The result of user interface redesign of IBOSS is designed by applying 5 basic gestalt principles, namely proximity, similarity, continuity, closure, and figure and ground.

The application of the proximity principle can be seen in the placement of the position of elements that have a relationship placed close together and gathered at a certain point. Furthermore, the application of the similarity principle is that elements that have the same shape are placed close together, but given a difference in the form of colour. Based on gestalt theory, humans will immediately group objects that look similar in shape. Then to make it easier to identify its function, it is given a different colour such as the 'cancel' button in red and the 'submit' button in blue.

The principle of continuity is applied by placing elements forming a line like a straight line. The application of the figure and ground principle is the most crucial. This is because this website has more writing and columns for filling in data so that if the background used is not the right colour selection, the writing will be difficult to see by users.

Finally, the closure principle is applied to some icon shapes that look like flat shapes that are not intact. However, this theory explains that psychologically even though the shape seen by the user is not intact, the user's mind has recorded the original shape of the icon so that it is easily recognised by the user.

3.4 Thematic Analysis Result

Qualitative data was obtained from interviews conducted with experts. The interview was conducted twice, before the redesign and also after the redesign. The interview results were grouped into 10 categories according to the number of heuristic principles used. Table 5 is the coding of thematic analysis results from qualitative data from interviews before redesign.

Table 5. Expert analysis results before redesign

Code	Categori/theme	Description
H1	Visibility of System Status	1) There is no status information from the system regarding where the user's submission has reached, such as a timeline or at least a notification when the web is opened. 2) When I try to submit a form, I don't know if it has been sent or not because there is no notification.

Code	Categori/theme	Description
H2	Match Between System and the Real World	1) The language is good using standardised language, but there are some vocabulary words that are too standardised and I even think that these words are very foreign because we never use them. Maybe the vocabulary can be improved. 2) There are some icons that would be better if the shape was changed so that they are more familiar to users.
H3	User Control and Freedom	1) The location of the buttons and icons is confusing. The missing button is the cancel button for actions that have already been performed. 2) From here it can be seen that there is no cancellation button. Even the button to exit the website is difficult to find, not on every page.
H4	Consistency and Standards	1) It seems that the use of words is not consistent, some are Indonesian and some are English. The position of the navigation menu also moves around on each page. 2) The size of each panel is different, so it looks inconsistent at all. The information panel is too large in size, so it is obstructive. 3) The layout of the form is a mess of letters, so it looks like a website for a class of students who are still learning unprofessionally.
H5	Error Prevention	1) The warning is there for users to be more thorough, but the panel size is too small. 2) There is no navigation menu to access the guide so users have no guidance and are prone to making mistakes. 3) There is no action verification request that contains the consequences of the action so users do not know if this button is clicked what will happen. It's quite tricky for users.
H6	Recognition Rather than Recall	1) The display is already simple to remember. Maybe a little improvement is needed in the placement of letters and icons because it is still not neat. 2) I forgot where the navigation buttons are because every page the position changes.

Code	Categori/theme	Description
H7	Flexibility and Efficiency of Use	3) The appearance is favourable for efficient use by users, but the cluttered layout is a problem as it takes time to find the navigation buttons.
H8	Aesthetic and Minimalist Design	1) The display design is aesthetic and has been very minimalist accordingly because this is a government website for public services. 2) The overall appearance design is like dark and light, the content is quite good. Given that this is a ministry website, it should be like this, not many frills.
H9	Helps User Recognize, Diagnose, and Recovers User	1) The error information is there, but there is no option for the user to restore the system. 2) It can be added to the redesign so that there is an option for recovery, such as returning to the previous page. 3) Add detailed information about what the error is and why so that it helps users to diagnose.
H10	Helps and Documentation	1) There is actually a user guide to help users complete with documentation. But strangely there is no button icon for easier access. Please add it. 2) Additional navigation menu to access the guide menu will greatly help users when using this website.

Based on the results of the analysis above, it can be seen that the problems of the user interface of the IBOSS include the neatness of the layout of its elements, the use of language that is difficult to understand, the use of inconsistent language, the shape of icons that are not familiar to users, and navigation buttons that are not available and information that is less detailed to users.

The results of thematic analysis are also taken into consideration in redesigning the user interface of IBOSS along with the results of descriptive statistical analysis. After the redesign was completed, interviews were conducted again with experts to ensure that the redesign was appropriate and made the user interface of the IBOSS look better. Table 6 is the coding of thematic analysis results from interviews after the redesign.

Table 6. Expert analysis results after redesign

Code	Categori/theme	Description
H1	Visibility of System Status	1) After the redesign, the addition of the timeline design on the dashboard is very appropriate because this is what users need to know the stages of their submission. 2) A good solution is to add an application timeline design that is placed on the dashboard, so users no longer need to open too many pages.
H2	Match Between System and the Real World	1) After this redesign, the language is more pleasing to the eye. Although it turns out that there are some words or terms that are easier to recognise with English, it doesn't matter. The redesign result is good 2) The improvement of words after the redesign is better and more appropriate. The placement of the word usage is also appropriate. 3) The icon shape change is suitable.
H3	User Control and Freedom	1) Setelah di redesain kelihatan lebih mudah digunakan. Posisi ikon dan tombol navigasi mudah diakses dan ada di semua halaman jadi tidak membingungkan. 2) Di hasil redesain ini pengguna jadi bisa berinteraksi lebih bebas. Menu navigasi yang dibutuhkan pengguna dapat dilihat dengan jelas dan yang paling penting adalah ada pilihan untuk membatalkan.
H4	Consistency and Standards	1) The improvements in the redesign are seen to make the website look better because the consistency is neater. 2) It is more pleasant to look at, the size of the elements is consistent on each page and does not interfere with other elements. 3) For the layout of the form, it is also tidier and more pleasing to the eye.
H5	Error Prevention	1) The increase in the size of the shape after the redesign has a significant effect. Users can more clearly see the warning and realise to double-check. 2) This is good in my opinion because there is verification from the user and then processed by the system. So there are no wrong steps for users
H6	Recognition Rather than Recall	1) The icon images used in this redesign are very familiar. It does feel like cheating on existing

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		websites but this is good because users will understand more quickly and not be confused. 2) The position of the navigation buttons is pleasing to the eye and well visible.
H7	Flexibility and Efficiency of Use	1) The redesign results can be used more efficiently and save time by users. It looks more organised and easy to remember. 2) If I were a user, it would be more efficient to use than before.
H8	Aesthetic and Minimalist Design	From the beginning, the general appearance was already good, as mentioned earlier. But after this redesign, it's even better to keep looking at, it looks cleaner and more elegant.
H9	Helps User Recognize, Diagnose, and Recovers User	1) The redesign results are in accordance with the assessment and user needs. The addition of navigation buttons is appropriate. 2) The information details are very informative, if this is how the user understands what is actually happening with the system. 3) From this simulation, it becomes more comfortable to use. I mean, if there is a problem, the information is clear why and how should I do next.
H10	Helps and Documentation	1) The addition of a guide menu button on the decision page is good. It makes it easier for users to just open the guide if they don't know. 2) It is good that the icon is placed in a position that is easy for users to see. 3) If this is appropriate. Make it easier for ordinary users, especially when they want to use the website.

Based on the table above, it is known that the user interface redesign of the IBOSS produces a better user interface than before. It can be seen in the description column that the experts give opinions stating that it is better than before the redesign.

4. CONCLUSION

The results of this study indicate that the usability of the IBOSS user interface initially has several usability problems that are well identified using the heuristic evaluation method, where 9 out of 10 variables fall into the minor usability category that needs to be fixed with a low priority, and one variable, namely aesthetics and minimalist design, falls into the cosmetic category which means it does not need to be fixed. Based on qualitative analysis of the results of interviews

with experts using thematic analysis techniques, before the redesign the experts gave opinions that were in line with the results of quantitative analysis before the redesign. Based on the results of this analysis, a redesign of the IBOSS interface was carried out by applying the five gestalt principles. after the redesign, the next interview was conducted again with the experts. the results of the qualitative data analysis of the interview results show an increase in the appearance of the IBOSS interface after being redesigned. this is known from the opinions of experts who state that the design is better than before being redesigned. thus, it can be concluded that usability analysis using the heuristic evaluation method is effective to find out more details about the problems contained in the IBOSS interface and the redesign carried out by applying the gestalt principle has also proven effective in making the IBOSS interface look better.

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