Factors influencing interface design skills

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Abstract. This study aims to reveal several factors that affect student’s interface designing skills. There are some variables that influence student’s competencies encompassing motivation and prior knowledge, which determine the success of maximizing student’s cognitive and interface designing skills. This study used quantitative research approach with 39 total university students. The obtained data were analyzed using Path Analysis that measured cause-effect phenomena occurred in a multiple regression. In accordance with the results of SPSS Amos, the value of Chi-Square was 0.236, Df = 1 with p = 0.627. As the p value was more than 0.05, so that the analysis model result was not significantly different from the data. The estimation value between the values of prior knowledge and interface designing skills was very strong (β = 0.912). This indicated that there is a significant influence of prior knowledge on interface designing skills, whereas, there was a weak relationship between other variables. Therefore, the analysis model was precise to portray the relationships between variables and the variable of prior knowledge became the most influential factor on student’s interface designing skills.

1. Introduction

Now, the development of sophisticated technology could be indicated through the advancement of Information Technology (IT) and computers. In Indonesia, the development of IT is much more rapid compared to other aspects or sectors. Every information technology has an interface that functions to bridge between the user and the technology itself. Making a user interface aims to make information technology easier to use. The term user-friendly refers to the capabilities of software or application programs that are easy to operate and have a number of other experiences so that users feel comfortable in operating the program [1]. Complex user interface will make the users face difficulties and errors during the usage or operation. Therefore, this study aims to reveal the factors that affect students' skills in creating user-friendly interface design.

1.1. Human Computer Interaction

Human Computer Interaction (HCI) is a combination of a computer with an interface designed for initiating the information input and output that are user-friendly, creating communicative and universal information technology, showing human and computer interaction. [2]. User-friendly is one of the important characteristics that must be possessed if someone will develop an interface design. HCI has developed rapidly as the existence of a Human-Engaged Computing (HEC) approach. HEC focuses on the development of HCI that is easy to adapt to philosophical approaches and aims to build...
synergistic interactions between humans and computers.[3]. Personal computers now allow complex forms of user interaction. Unlike the older mainframe computers that require batch processing, personal computers allow real-time user control on a one-to-one basis. Such user interactions involve mixed initiatives (initiatives from humans and computers), logic, programming languages, pointing gestures, and features that encourage human-computer interactions. [4]. Teaching HCI is often a challenging experience since the skills of HCI are different from the cognitive and computational thinking skills that become the focus of most curriculum. The teaching of HCI is often carried out as a series of lectures that learn concepts but lacks of improving student’s designing skills. Previous study found that the experience of the HCI teaching model provided good results and advancement of the future HCI teaching process.[5]. It is expected that the Human and Computer Interaction course will support students with competencies about interaction between humans and computers, the development of human and computer interactions, the creation of a good interface in program implementation, and the tendency of future HCI betterment. To achieve these competencies, there are several criteria that must be met namely: (1) Students can design user interface with correct procedures, (2) Students can make documentation of user interface design correctly, and (3) Students can implement the user interface design.

1.2. Interface Design

The use of a systematic approach is required to improve usability. Such approach helps designers to identify designing problems, reveal user needs, create a user-friendly design, use an architecture system, assess completed systems and prototypes, and evaluate the overall aspects methodically. [6]. Usability is very important for developing user-friendly interfaces, however, still limited studies that provide an interface development based on the principles of usability. A study was conducted by looking at the usability attributes and design elements that were appropriate to a learning perspective. The results showed that the usability design elements identified through the use of repetitive designs and evaluation models were very significant to improve the usability of the user interface and finally facilitate the users to learning process. [7]. Comprehensive analysis of usability evaluation and user acceptance showed that an interface based on a user-centered design provided user’s satisfactions. This study provides significant additional information and improvements to the user interface using a user-centered design approach. [8]. Specifically, some researchers identified important features of interface design namely learnability, effectiveness, efficiency, and satisfaction as the main attributes of usability. They extracted useful design elements from the attributes and then reviewed them under a learning perspective. [7].

1.3. Influential Factors on Designing Skills

Students must be equipped with the ability to create and implement interface designs using appropriate and systematic procedures to produce a good interface. There are several factors that affect the sequential processes, of which these factors comprise motivation, initial ability, cognitive ability, and interface design itself. Motivation is a reason to act or behave in a certain way and can be referred to the underlying behavioral reasons. [9] Gredler in Broussard and Garrison broadly defines motivation as an attribute that moves a person to do or do not do something.[10]. Motivation is an ambition to pursue important things including both material and spiritual, such as security, love, self-esteem, and self-actualization. It also can be defined as a reason that underlies someone to act to do the activities or things that are desired by determining the expected goals. The next factor is cognitive ability. Several theories of cognitive abilities have developed and progressed rapidly with regard to complex cognitive learning where students are often overwhelmed because of the many elements of information that need to be processed simultaneously before coming to the core learning. [11]. A person's cognitive abilities is also strongly influenced by his memory abilities, Long Term Memory/LTM, and Working Memory/WM. [12]. To develop human and computer interfaces, developers must have good cognitive abilities especially on the structure and representational dynamics of cognitive systems that interact with computers.
2. Methods

2.1. Data Collection Procedure

This study used a quantitative research approach. The samples were 39 students at the Department of Informatics majoring Information Systems, 2018 class, who programmed Human and Computer Interaction course. The data collection procedure resulted on four variables namely X1 as student motivation, X2 as the students’ prior knowledge related to understanding the material of human and computer interaction, Y1 as students’ cognitive ability, and Y2 as the students’ interface designing skills. Table 1 depicts the information of the four variables.

| Number of Student | X1  | X2  | Y1  | Y2  |
|-------------------|-----|-----|-----|-----|
| 1                 | 84.00 | 85.00 | 70.00 | 80.00 |
| 2                 | 73.00 | 80.00 | 35.00 | 75.00 |
| 3                 | 81.00 | 80.00 | 65.00 | 80.00 |
| 4                 | 70.00 | 80.00 | 80.00 | 75.00 |
| 5                 | 80.00 | 90.00 | 65.00 | 85.00 |
| 6                 | 71.00 | 80.00 | 65.00 | 80.00 |
| 7                 | 66.00 | 90.00 | 65.00 | 90.00 |
| 8                 | 77.00 | 75.00 | 55.00 | 75.00 |
| 9                 | 82.00 | 65.00 | 75.00 | 65.00 |
| 10                | 74.00 | 75.00 | 60.00 | 70.00 |
| 11                | 84.00 | 80.00 | 85.00 | 80.00 |
| 12                | 70.00 | 85.00 | 45.00 | 85.00 |
| 13                | 75.00 | 80.00 | 95.00 | 75.00 |
| 14                | 79.00 | 75.00 | 55.00 | 70.00 |
| 15                | 75.00 | 80.00 | 65.00 | 75.00 |
| 16                | 77.00 | 85.00 | 70.00 | 80.00 |
| 17                | 79.00 | 85.00 | 45.00 | 85.00 |
| 18                | 69.00 | 75.00 | 45.00 | 75.00 |
| 19                | 85.00 | 80.00 | 90.00 | 75.00 |
| 20                | 72.00 | 75.00 | 50.00 | 75.00 |
| 21                | 66.00 | 65.00 | 60.00 | 65.00 |
| 22                | 71.00 | 85.00 | 40.00 | 80.00 |
| 23                | 72.00 | 90.00 | 85.00 | 90.00 |
| 24                | 67.00 | 75.00 | 85.00 | 75.00 |
| 25                | 69.00 | 75.00 | 45.00 | 75.00 |
| 26                | 90.00 | 80.00 | 50.00 | 80.00 |
| 27                | 70.00 | 80.00 | 60.00 | 75.00 |
| 28                | 73.00 | 85.00 | 70.00 | 85.00 |
| 29                | 84.00 | 80.00 | 55.00 | 75.00 |
| 30                | 94.00 | 75.00 | 75.00 | 75.00 |
| 31                | 69.00 | 75.00 | 65.00 | 70.00 |
| 32                | 72.00 | 80.00 | 60.00 | 75.00 |
| 33                | 70.00 | 80.00 | 80.00 | 75.00 |
| 34                | 73.00 | 80.00 | 65.00 | 80.00 |
| 35                | 62.00 | 65.00 | 65.00 | 65.00 |
| 36                | 70.00 | 90.00 | 70.00 | 90.00 |
| 37                | 77.00 | 90.00 | 90.00 | 90.00 |
| 38                | 84.00 | 80.00 | 60.00 | 80.00 |
| 39                | 65.00 | 90.00 | 65.00 | 80.00 |
2.2. Data Analysis Technique
The data analysis technique used path analysis, a method to look for cause and effect relationships that occurred in multiple regression. Here, the independent variables might affect the dependent variable both directly and indirectly. Some steps that must be undertaken in path analysis included: 1) drawing a path diagram in accordance with the theory when the data were ready to process, 2) performing a regression analysis, 3) comparing the estimated regression (β) with the theoretical assumptions of other studies, 4) modifying the model by adding or subtracting the path that connected between variables which were intended to see the effect of each independent variable on the dependent variable. This study used SPSS AMOS software to perform the analysis process.

3. Results and Discussion

3.1. Model Analysis Results
By using SPSS Amos Program, this study used the following model for data analysis.

![Figure 1. Model Analysis Results from SPSS AMOS Standardized Estimates](image)

With the model in Figure 1 above, the results are as follows:

**Figure 2. Results of analysis using SPSS AMOS**

\[ \text{Chi-Square} = 0.236 \text{ (the smaller the better), Degrees of Freedom} = 1 \text{ which meant insignificance with } p \text{ value} = 0.627. \text{ Because } p > 0.05 \text{ the analysis model was not significantly different from the data or, in other words, the fit model agreed the data.} \]

3.2. Parameter Estimation
The next step was the analysis of parameter estimation using Maximum Likelihood Estimates with Regression Weights. The following figure shows the analysis results
In accordance with the analysis results, \( p = 0.427 \), which means that students’ motivation did not affect students’ cognitive skills. Likewise, there was a significantly difference between students’ prior knowledge and their cognitive skills, as well as the students’ cognitive skills ans their interface designing skills \( (p > 0.05) \). The C.R value above showed the critical ratio value obtained from the estimation value divided by the standard error (S.E). The higher the C.R value, the more significant it was. The C.R values above 1.96 would produce a significant estimation value at 5%, whereas, the values that were above 2.56 would be significant at 1%. Figure 4 presented a standardized estimation value.

Table 2. Standardized Direct Effects

| Variable          | Kemampuan_awal | Motivasi_mhs | Kemampuan_kognitif |
|-------------------|----------------|--------------|-------------------|
| Kemampuan_kognitif| .111           | .127         | .000              |
| Desain_Interface  | .912           | .000         | -.003             |

Table 3. Standardized Indirect Effects

| Variable          | Kemampuan_awal | Motivasi_mhs | Kemampuan_kognitif |
|-------------------|----------------|--------------|-------------------|
| Kemampuan_kognitif| .000           | .000         | .000              |
| Desain_Interface  | .000           | .000         | .000              |
Table 2 portrayed that there was a direct influence of students’ prior knowledge on their interface designing skills ($\beta = 0.912$), while there was an indirect influence depicted in Table 3 ($\beta = 0.000$). The direct influence was greater than the indirect ones.

### 3.3. Index of Accuracy Model

| Model            | NPAR | CMIN | DF | P   | CMIN/DF |
|------------------|------|------|----|-----|---------|
| Default model    | 9    | .236 | 1  | .627| .236    |
| Saturated model  | 10   | .000 | 0  |     |         |
| Independence model | 4   | 68.844 | 6  | .000| 11.474  |

Table 4 above shows the CMIN value of 0.236 ($p > 0.05$). P values above 0.05 indicated no difference between the data used to analyze and the model developed. In other words, the model represented the data. The analysis results also produced an expected index value of GFI (Goodness of Fit Index) above 0.9. If the GFI value was getting closer to 1, it was better. Henceforth, it could be concluded that the model developed really fit the data shows in table 5.

| Model            | RMR | GFI | AGFI | PGFI |
|------------------|-----|-----|------|------|
| Default model    | .468 | .997 | .969 | .100 |
| Saturated model  | .000 | 1.000 |      |      |
| Independence model | 13.729 | .695 | .492 | .417 |

### 4. Conclusion

By using SPSS AMOS Program, the analysis model is not significantly different from the data, meaning that the model fits the data as $p > 0.05$. It can be interpreted that the model represents the relationship of each variable. Furthermore, the estimation value of the relationship between variables shows that there is a strong and direct influence of the variable of students’ prior knowledge on the variable of students’ interface designing skills. This is proven by the estimation value of the relationship between the two variables (0.912) that shows a very strong relationship compared to the relationship between other variables.

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