

Human-Computer Interaction and Knowledge Transfer: Study of E-Learning Achievement

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Abstract—Human-computer interaction influences the effectiveness of e-learning knowledge transfer, so it is necessary to pay attention to user engagement and achievement. The aim of this research is to examine the factors that support e-learning knowledge transfer through achievement and user engagement (self-efficacy, self-confidence, self-esteem). The research method was carried out by surveying e-learning users, namely students, data from students was collected through quantitative questionnaires. The data is then processed using the SmartPLS tool through two tests, namely the PLS Algorithm and Bootstrapping. The model was tested using inner and outer tests, and the data was analyzed based on the research hypothesis design. Student interactions with e-learning influence several behaviors that can support e-learning knowledge transfer performance. The research results prove that student e-learning achievement has a positive impact on e-learning knowledge transfer. Several supporting factors play a role in increasing e-learning achievement, namely self-efficacy, self-confidence and self-esteem of students. However, the supporting factors for students are only self-efficacy and self-confidence which are directly able to increase e-learning knowledge transfer. It is known that students who are less able to respect themselves in interacting with e-learning are unable to support knowledge transfer. The rules of human-computer interaction play a role in supporting e-learning knowledge transfer, studies on user behavior need to be considered, especially self-efficacy and self-confidence to support online learning academic performance.

Keywords— human computer interaction, e-learning, knowledge transfer

I. INTRODUCTION

Human-computer interaction is a science that is side by side between computer science and cognitive psychology [1]. Human-computer interaction contributes to system development interfaces, such as e-learning interfaces [2], [3], [4]. Provide a good experience when users use online platforms for learning media. Development of human-computer interaction to increase user accessibility, which supports user learning outcomes on e-learning platforms [5], [6]. This explains that the interface is an important part in conveying knowledge from e-learning to users. Human-computer interaction has experienced significant development, including in the e-learning area by providing

user-centered design to pay attention to the needs of e-learning users [7], an adaptive learning system to adjust content according to user needs [6] and a natural user interface to support interaction between users and e-learning which is more natural or familiar [8]. The aim of the presence of human-computer interaction science in e-learning is to support learning outcomes through knowledge transfer [9].

There is a social cognitive theory related to human-computer interaction which is known as self-efficacy, self-confidence and self-esteem [10]. Many previous research studies explain that social cognitive theory has an impact on academic achievement [11], including in e-learning. It can be explained indirectly that self-efficacy, self-confidence and self-esteem are able to support the achievements of e-learning knowledge transfer among students as e-learning users. The main thing that needs to be known about e-learning knowledge transfer is the success in receiving information by users [12], [13], [14]. E-learning as a forum for knowledge is designed with a user interface according to user needs, ultimately supporting the knowledge transfer process [6]. By understanding user behavior on online platforms, it supports the achievement of e-learning knowledge transfer. In the study of self-efficacy, self-confidence and self-esteem are related to user experience, which is closely related to achievement in the end [15]. E-learning achievement is the achievement felt by students after interacting with online platforms [16], [17]. This explains that internal factors are needed from students to support e-learning achievement, this is reflected in students' confidence in interacting with e-learning, and students' confidence in assessing their ability to learn using online platforms. The essence of this study explains the impact of self-efficacy, self-confidence and self-esteem on students' e-learning achievements.

The initial study conveyed the importance of human-computer interaction in supporting student e-learning knowledge transfer. So this research aims to examine the support of self-efficacy, self-confidence and self-esteem in e-learning knowledge transfer through the mediation of e-learning achievement. The research position in the study of social cognitive theory is student behavior in interacting with e-learning and its impact on e-learning knowledge transfer.

The study was carried out by testing a model that supports achieving e-learning knowledge transfer.

II. LITERATURE REVIEW

A. Self-Efficacy, Self-Confidence and Self-Esteem

In connection with online learning behavior, there is a social cognitive theory known as self-efficacy, self-confidence, and self-esteem [10]. Self-efficacy is the belief that students can interact and complete all tasks through online learning [15]. Confidence in adapting well to online platforms has an impact on student learning performance [18], [19], [20]. Likewise, self-confidence is also able to support student learning achievement. In general, self-confidence is expressed as the ability to understand online learning material well and support student self-confidence [21]. Self-confidence is generally related to students' confidence in interacting with e-learning [18], while self-efficacy focuses on confidence in completing assignments [22], [23], [24]. Another theory explains self-esteem, which explains students' self-esteem for their ability to interact with online platforms [25]. This has an impact on students' emotional levels and supports student learning performance online [26].

Theories on self-efficacy, self-confidence, and self-esteem are related to one another. In consumer psychology, support for these three behaviors in self-development is provided [10]. In general, it is said that self-efficacy can be assessed through several indicators, including completing the task, good adoption, independence, to be a master, able to use all features, and learn actively [15], [27], [28]. Self-confidence is assessed from the indicators of self-image, think positively, connect with others, act confidence, help others, and be enthusiastic [21]. Furthermore, in studying self-esteem, several measurement indicators are used, including satisfied my self, good person, good quality, able to perform, proud, usefull, and respect [10], [29].

B. E-Learning Achievement

Student learning achievements can be assessed both onsite and online, where student learning achievements indicate the success of the learning process [30]. E-learning achievement explains students' academic achievements from learning using online platforms [31]. There are main components to pay attention to in e-learning achievement, including those related to student involvement, student knowledge and academic performance [32]. The ultimate goal of e-learning achievement is to support the student's academic achievement process [15], [33], in this case it can be assessed from the success of e-learning knowledge transfer [25]. The ultimate goal of e-learning achievement is to support student academic performance. In general, it is known that several measurements can be taken, including assessing students' views on valuable learning experience, helpful learning experience, take another course, more aware of the knowledge, earning experience, worked hard, and developing new ways [15], [31], [33].

C. E-Learning Knowledge Transfer

In e-learning there is interaction between users, namely students, and computers, this allows knowledge transfer to occur for users because of experience in adapting to e-learning [31]. E-learning has learning content, meaning the transfer of knowledge that occurs in a scientific context [11]. In general, it is said that e-learning knowledge transfer is the process of transferring knowledge from online platforms to users, in this

case students [33]. E-learning knowledge transfer is in line with the aim of e-learning, namely the dissemination of knowledge, where this knowledge can be well received by users [31]. Many factors can support e-learning knowledge transfer, including user behavior when adapting to e-learning [34], [35]. Interaction in e-learning provides opportunities for academic achievement and ultimately supports e-learning knowledge transfer. Several indicators that are commonly used in evaluating e-learning knowledge transfer include students' views on learning new knowledge, applying my learning, daily work and performance improvement [31], [33].

D. Hypothesis Development and Model

Hypothesis development explains the support from previous research in determining the current research model. There are studies from previous research that explain the relationship between self-efficacy, self-confidence and self-esteem on e-learning achievement [15], [21], [25] as well as in e-learning knowledge transfer [11], [33], [36]. In other research that focuses on e-learning, it also explains the positive impact of e-learning achievement on knowledge transfer felt by users [31], [33]. In line with previous research, the research hypothesis design is presented as follows.

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|-------------------|---|
| Hypothesis 1 (H1) | Self-efficacy of students have positive influence to e-learning achievement. |
| Hypothesis 2 (H2) | Self-confidence of students have positive influence to e-learning achievement. |
| Hypothesis 3 (H3) | Self-esteem of students have positive influence to e-learning achievement. |
| Hypothesis 4 (H4) | Self-efficacy of students have positive influence to e-learning knowledge transfer. |
| Hypothesis 5 (H5) | Self-confidence of students have positive influence to e-learning knowledge transfer. |
| Hypothesis 6 (H6) | Self-esteem of students have positive influence to e-learning knowledge transfer. |
| Hypothesis 7 (H7) | E-learning achievement have positive influence to e-learning knowledge transfer. |

III. METHODS

The research method in this study uses a survey with quantitative data. A survey was conducted on students in Bandung City (Indonesia) who had implemented learning methods via e-learning. Quantitative data was obtained from respondents, namely students, through a questionnaire with answers determined using a Likert scale approach. Graded answers start with a value of 1 for the criterion "strongly disagree" and a value of 5 for the criterion "strongly agree". Questionnaires were distributed online to respondents, then data tabulation, data screening and statistical data processing were carried out. Each question in the questionnaire is made based on the research instrument for each variable, where there are five variables, namely self-efficacy, self-confidence, self-esteem, e-learning achievement, and e-learning knowledge transfer. The research instrument for self-efficacy found six indicators [15], [27], [28], six indicators were used for self-confidence [18], [21] and seven measurement

indicators were used for self-esteem [10], [29], [37]. Seven indicators are used for e-learning achievement [15], [31], [33] and four measurement indicators are used for e-learning knowledge transfer [31], [33].

The research stages began with distributing questionnaires, data processing, research model testing (PLS Algorithm and Bootstrapping Process), hypothesis testing, analysis and discussion. Analysis and discussion are in line with the previous research hypothesis design.

IV. RESULT AND DISCUSSIONS

There are five variables studied for analysis in this research, including self-efficacy, self-confidence, self-esteem, and e-learning achievement, with the final aim of evaluating e-learning knowledge transfer. At this stage, data processing is carried out to find research results and discuss research results. Based on the results of distributing the questionnaire online, 546 respondents were obtained, namely students who filled out the questionnaire perfectly. The data was then tabulated, cleaned, coded and analyzed using the SmartPLS statistical tool. Two statistical tests were carried out, namely the PLS Algorithm and Bootstrapping Process to test the research model [38]. The research model tested was based on the previous research hypothesis design. There are seven research hypotheses which will be further analyzed as a discussion of the research. The results of the PLS Algorithm test (Fig. 1) show that there is a positive relationship between research variables. This means that the research model is able to explain support for the achievements of e-learning knowledge transfer. This is in line with the results of the research instrument test (TABLE II), where the validity and reliability tests were accepted by evaluating the Cronbach's α , Composite Reliability and AVE values that met standard criteria (values above 0.700). All research instruments support the study model (Fig. 1), where it is known from the outer test values for all instruments that P-Value meets the requirements in TABLE III (P-Value below 0.050).

In the Bootstrapping Process test, the correlation value is known to test the research hypothesis. The summary of the test results shows that all research hypotheses are supported except hypothesis 6 (TABLE I). Further analysis and discussion of the hypothesis test results are presented in the next sub-chapter as research findings.

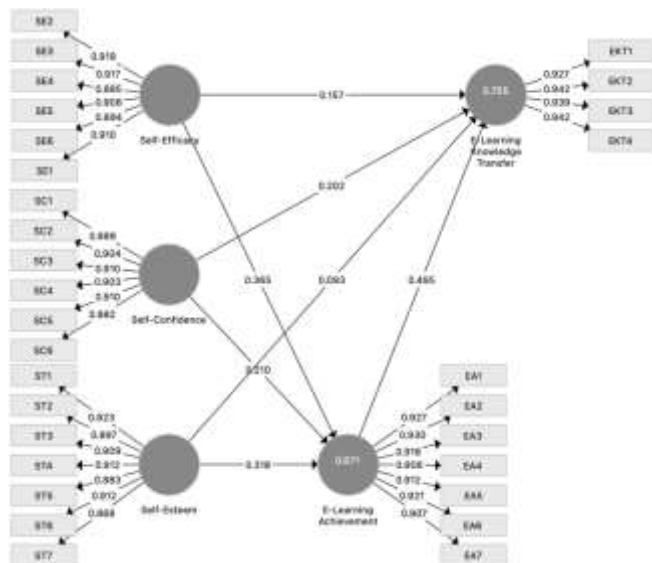


Fig. 1. Hypothesis Model Test

TABLE I. PATH COEFFICIENT TEST

Path Coefficient	T Stats.	P-Values	Result
H1: Self-Efficacy -> E-Learning Achievement	6.389	0.000	Support
H2: Self-Confidence -> E-Learning Achievement	2.691	0.007	Support
H3: Self-Esteem -> E-Learning Achievement	5.034	0.000	Support
H4: Self-Efficacy -> E-Learning Knowledge Transfer	2.264	0.024	Support
H5: Self-Confidence -> E-Learning Knowledge Transfer	2.806	0.005	Support
H6: Self-Esteem -> E-Learning Knowledge Transfer	1.521	0.128	Rejected
H7: E-Learning Achievement -> E-Learning Knowledge Transfer	6.272	0.000	Support

TABLE II. INSTRUMENTS TEST

Constructs	Cron. α	Comp. Reliability	AVE
Self-Efficacy	0.956	0.965	0.820
Self-Confidence	0.953	0.962	0.810
Self-Esteem	0.954	0.963	0.786
E-Learning Achievement	0.969	0.974	0.842
E-Learning Knowledge Transfer	0.954	0.967	0.878

TABLE III. OUTER TEST

Constructs	Stand. Dev.	T Stats.	P-Values
SE1 <- Self-Efficacy	0.012	76.789	0.000
SE2 <- Self-Efficacy	0.011	81.011	0.000
SE3 <- Self-Efficacy	0.012	74.064	0.000
SE4 <- Self-Efficacy	0.014	64.090	0.000
SE5 <- Self-Efficacy	0.014	66.685	0.000
SE6 <- Self-Efficacy	0.015	60.096	0.000
SC1 <- Self-Confidence	0.015	58.379	0.000
SC2 <- Self-Confidence	0.021	43.443	0.000
SC3 <- Self-Confidence	0.013	70.796	0.000
SC4 <- Self-Confidence	0.012	77.346	0.000
SC5 <- Self-Confidence	0.013	71.149	0.000
SC6 <- Self-Confidence	0.017	50.620	0.000
ST1 <- Self-Esteem	0.021	39.659	0.000
ST2 <- Self-Esteem	0.013	70.109	0.000
ST3 <- Self-Esteem	0.011	82.730	0.000
ST4 <- Self-Esteem	0.012	78.258	0.000
ST5 <- Self-Esteem	0.016	55.356	0.000
ST6 <- Self-Esteem	0.011	79.708	0.000
ST7 <- Self-Esteem	0.027	31.595	0.000
EA1 <- E-Learning Achievement	0.011	88.210	0.000
EA2 <- E-Learning Achievement	0.010	92.483	0.000
EA3 <- E-Learning Achievement	0.012	78.235	0.000
EA4 <- E-Learning Achievement	0.013	69.889	0.000
EA5 <- E-Learning Achievement	0.012	73.645	0.000
EA6 <- E-Learning Achievement	0.011	83.788	0.000
EA7 <- E-Learning Achievement	0.015	60.631	0.000
EKT1 <- E-Learning Knowledge Transfer	0.011	84.017	0.000
EKT2 <- E-Learning Knowledge Transfer	0.009	109.797	0.000
EKT3 <- E-Learning Knowledge Transfer	0.009	100.257	0.000
EKT4 <- E-Learning Knowledge Transfer	0.010	96.412	0.000

A. The Influence of Self-Efficacy, Self-Confidence and Self-Esteem in E-Learning Engagement

E-Learning is part of human-computer interaction, because it involves interaction between users and e-learning

in the learning process. This means that user experience is needed in evaluating e-learning performance. There is user interface design and user experience that are considered to measure user adaptation performance in e-learning. Interactive learning often involves the abilities of users, in this case students, of course related to self-efficacy, self-confidence and self-esteem. In this research, it is stated that self-efficacy, self-confidence and self-esteem have a positive relationship and are able to increase student e-learning achievement (TABLE I). Taking a deeper assessment, it is known that self-efficacy has a better role in increasing students' e-learning achievement (Fig. 1), known from the correlation value which is greater, namely 0.365, compared to self-confidence and self-esteem. Self-efficacy is a student's ability to use and complete tasks through e-learning, this ability ultimately supports student learning outcomes. This needs to be a main concern in order to support student achievement in the e-learning learning process. Confidence in facing e-learning learning and managing learning is the next support in e-learning achievement. In line with previous research that self-efficacy, self-confidence and self-esteem are part of social cognitive theory which is able to influence the achievement of new technology adoption [15], [21], [25].

The research results explain the impact of self-efficacy, self-confidence and self-esteem in increasing student e-learning achievement. The research findings are confirmed by testing the research hypothesis. Hypothesis test results (H1, H2, H3) explain all supported relationships (TABLE I), where the P-Value value meets the criteria (<0.050). Human-computer interaction has a positive impact on efforts to improve e-learning performance, through understanding interactive learning on student self-efficacy, self-confidence and self-esteem.

B. The Mediation of E-Learning Achievement for E-Learning Knowledge Transfer

Human-computer interaction is related to interactive learning which aims to improve user experience. In the end, human-computer interaction in the e-learning concept is useful in supporting e-learning knowledge transfer. The presence of online learning methods is the right choice for disseminating knowledge without knowing time and place. However, the achievements of learning through e-learning continue to be studied, especially factors related to human-computer interaction. Because interactive learning provides positive support for e-learning achievement. The research results show that e-learning achievement directly has a positive relationship in supporting e-learning knowledge transfer achievements. This is confirmed by testing the research hypothesis (TABLE I), namely H7 is supported. In line with previous research studies which explain that the advantage of e-learning is freedom of place and time, so that learning outcomes can be carried out independently and support easier knowledge transfer [31], [33].

More in-depth testing was carried out directly from students' experiences in interacting with e-learning, this is related to self-efficacy, self-confidence and self-esteem. The direct test results show that all student experiences have a positive relationship with e-learning knowledge transfer, but the only ones that have a direct significant impact are self-efficacy and self-confidence. Self-esteem is student behavior in assessing themselves and responding to learning outcomes with e-learning. It is known that it does not have a direct impact on knowledge transfer (Fig. 1), it is also known from

the results of the hypothesis test (TABLE I) that H6 is rejected. In contrast to H4 and H5, self-efficacy and self-confidence significantly influence knowledge transfer (TABLE I). In previous studies, it was stated that the importance of self-esteem is related to the evaluation of user interactions with computers. However, there are obstacles that can weaken the impact of self-esteem on knowledge transfer, namely doubt and low involvement in e-learning [36]. This is a limitation so that it may not support the achievement of e-learning knowledge transfer.

A deeper study shows that self-efficacy and self-confidence can influence e-learning knowledge transfer both directly, but better when mediated by e-learning achievement. In line with these findings, it can be emphasized that e-learning achievement can be an appropriate mediation in supporting e-learning knowledge transfer achievements. The essence of the research found a model that is able to support the achievement of e-learning knowledge transfer through mediating support from e-learning achievement. These findings are input for universities as one of the providers of online learning methods, where before implementing the development of an e-learning platform, attention is needed to features that support good adaptation to student self-efficacy and self-confidence. This aims to improve students' academic performance through learning methods via online platforms. Some features that can be considered are for example in tutorials, consultations either synchronously or asynchronously. This is believed to support students' e-learning achievements.

V. CONCLUSION AND RECOMMENDATION

E-learning is an online learning method that is effective at university level. Learning achievements through e-learning are known from the performance of e-learning knowledge transfer. Support from the behavior of e-learning users is needed to support the performance of e-learning adaptations, including those related to student engagement and achievement. Human-computer interaction has an impact on the performance of e-learning adaptation, which is directly related to student engagement in e-learning. One of the aspects of human-computer interaction is related to the design of e-learning interactions, so that it influences student involvement in the learning process, especially the performance of e-learning knowledge transfer. The research results explain that there are three behaviors of student engagement, namely self-efficacy, self-confidence and self-esteem, which have a positive relationship in supporting e-learning directly. However, regarding the performance of e-learning knowledge transfer, only students' self-efficacy and self-confidence can have an influence. The findings were directly conveyed that students' e-learning achievements were able to influence e-learning knowledge transfer achievements. The research findings explain that e-learning achievement is a good mediation in achieving e-learning knowledge transfer through the support of positive self-efficacy, self-confidence and self-esteem.

The research findings explain that not all behavioral factors of students support e-learning knowledge transfer directly, so it is necessary to find other supporting factors that are in line, such as self-regulation and self-motivation behavior of students in e-learning. Further suggestions need to be supported by studies of aspects of human-computer interaction in e-learning such as accessibility and personality, because they can increase knowledge transfer in e-learning.

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Doni Purnama Alamsyah: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing - Original Draft, Writing - Review & Editing, Supervision and Funding acquisition. **Norfaridatul Akmaliah Othman:** Conceptualization, Formal analysis, Investigation, Writing - Original Draft, Supervision and Funding acquisition. **Johan Muliadi Kerta:** Supervision. **Doni Morika:** Supervision. **Yudi Ramdhani:** Supervision.

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