Application of Analytical Hierarchy Process in Evaluating the Student Acceptance of E-Learning Implementation for Logic and System Modelling Learning

Rio Aurachman*, Muhammad Ardin Ghifari
Telkom University, Bandung, Indonesia

*r.ioaurachman@telkomuniversity.ac.id

Abstract. The logic and modeling of systems thinking are studied by students in various subjects, one of which is mathematics. An e-learning system can be used to learn these abilities. Survey was conducted using sample from student in Information system design courses. The data obtained was evaluated using the Analytical Hierarchy Process. The AHP method was chosen in order to obtain an effectiveness comparison between e-learning tools and face-to-face learning in the classroom.

1. Introduction
The COVID-19 pandemic is changing the way people behave. One of them is behavior in the teaching and learning process. The government prohibits face-to-face learning for some areas and for some levels of education. This causes education actors to adapt and adapt to these changes.

The online learning system has developed and grown. However, these developments did not run rapidly. This can be seen from the dominant face-to-face learning process. Online learning is positioned as a complement to the face-to-face learning process.

With the existence of COVID-19, people are forced to implement an online learning system. This condition raises several problems. However, the online learning system still has to be implemented with these various problems, while gradually the problems are resolved.

One important question is whether the teaching participants understand the importance of implementing this online learning system. Have the teaching participants perceived that this online learning system is better than the face-to-face learning system. Will this understanding be different if students get the context of COVID-19 and if there is no context COVID-19. Those are some of the questions that we try to answer through this research and paper. We try to find out the perceptions and readiness of each individual for the online learning system, especially with the COVID-19 context. The research was conducted using the pairwise comparison method and AHP (Analytical Hierarchy Process).

Several researchers have conducted research on the learning system in the middle of COVID-19. Several studies have reviewed the application of online learning in the midst of COVID-19 [1,2,3]. There is research that examines the importance of online learning in the midst of COVID-19 from a strategic planning perspective [4]. Other research tries to evaluate whether online learning is the right choice in the midst of this COVID-19 [5,6]. Other research has tried to evaluate online learning from a student's perspective [7]. One of the studies examines the project-based online learning method as a learning
method in the midst of the COVID-19 pandemic\cite{8}. There is also research that tries to suggest ways to increase student engagement in the midst of COVID-19\cite{9}. There is also research that proposes and compares several online learning methods\cite{10}. From some of these previous studies, there has not been any research that tries to examine how the context of COVID-19 affects students' perceptions of online learning systems.

2. Method and Algorithm
The survey was conducted on the student community in a class. The number of respondents was 40 people. Each respondent chooses which learning system is better, face-to-face or online learning. Comparisons were made of 17 dimensions or criterion. We get the criterion form another research which use Technology Acceptance Model approach\cite{11}. From the comparison options, the answer is converted into an AHP matrix. Then there is about 40 x17 = 680 comparison matrices for all criteria and alternatives. The comparison matrix formed is 2x2 in size. Because the comparison matrix is 2x2 in size, it can be ensured that the assessment matrix is perfectly consistent.

From about 40 respondents, the comparative answers for each criterion were averaged using the geometric mean. Then a matrix of comparisons of the combined results of 40 respondents is obtained. In more detail, there are 17 combined assessments from 40 respondents. Through the process of normalizing rows and columns, priority vectors are obtained for each assessment criteria. Priority vector is obtained for face-to-face learning systems and online learning systems. The priority vector value is different for each criterion.

The next stage is to get the combined value of all the criteria. It is assumed that the weight of each criterion is the same. The weight is multiplied by each priority vector value, then added up, so that the total value is obtained for face-to-face learning systems and online learning systems.

The whole process is carried out twice. The first process for the questionnaire without the context of COVID-19. While the second questionnaire was conducted with the context of COVID-19. The results of the two questionnaires were then compared and analyzed. One important analysis is which criteria change drastically after being given the context of COVID-19.

3. Result and Discussion
After a survey and assessment process is carried out, it can be seen in Table 1 that the priority vector value for each criterion and each learning system is without the context of COVID-19. Students were asked which learning system was better, when the pandemic was ongoing, but without explicitly conveying the conditions of COVID-19.

If the COVID-19 problem was not mentioned, respondents chose the face-to-face learning system as a better learning system for all criteria. This shows that in general, the online learning system has not been accepted by students. Even then, information about the pandemic was only just beginning to spread. Respondents answered in general conditions, without a pandemic, face-to-face learning systems are still preferred over online learning systems.

Criteria that have the highest score are easiness to use, easiness to learn, and positive attitude toward it. This shows that the online learning system, in general conditions, has weaknesses in terms of ease of use, convenience as a learning resource, and there is a negative perception of the learning system.

The criteria in which the online learning system achieves the highest score is the question of having important skills to use the online learning system, even though the value is still lower than face-to-face learning systems. This can indicate that respondents still need help with learning skills, even though it is for face-to-face learning systems. Another possible interpretation is, when asked about learning skills, and two options are presented between face-to-face learning systems and online learning systems, respondents prefer online learning systems because they feel that face-to-face learning systems don't require skills at all, which is something, which is wrong. These two interpretations still lead to the same thing, namely the importance of teaching learning skills to students.
Table 1. Perception of the Best Learning System with the Context of Covid-19

| Criteria                                                                 | Weight | On Class Meeting | Online Class |
|--------------------------------------------------------------------------|--------|-----------------|--------------|
| A. Learning system that is easier to use                                 | 0.05882 | 0.66667        | 0.33333      |
| B. Learning system that is easier to learn                               | 0.05882 | 0.66667        | 0.33333      |
| C. Learning system that is easier for me to become skilled at using it   | 0.05882 | 0.57087        | 0.42913      |
| D. Learning system which further enhances my learning performance       | 0.05882 | 0.61028        | 0.38972      |
| E. Learning system that will increase productivity and academic work     | 0.05882 | 0.62950        | 0.37050      |
| F. Learning system that makes it easier for me to learn lesson content   | 0.05882 | 0.59072        | 0.40928      |
| G. Learning system is better in my opinion                              | 0.05882 | 0.62950        | 0.37050      |
| H. A more discreet Learning System to use                                | 0.05882 | 0.62950        | 0.37050      |
| I. Learning system that I have a more positive attitude towards          | 0.05882 | 0.66667        | 0.33333      |
| J. The Learning System which more motivates me to view announcements and information frequently | 0.05882 | 0.61028        | 0.38972      |
| K. Learning system that encourages me to use more diligently             | 0.05882 | 0.62950        | 0.37050      |
| L. A Learning System that makes me feel confident that I will find the information I need | 0.05882 | 0.57087        | 0.42913      |
| M. My Learning System has the necessary skills to use                    | 0.05882 | 0.55079        | 0.44921      |
| N. Learning systems are more important to me as a student                | 0.05882 | 0.59072        | 0.40928      |
| O. The Learning System that I feel more comfortable using because it fits my values and culture as well as the values and culture of the community | 0.05882 | 0.62950        | 0.37050      |
| P. My preferred Learning System I prefer In order to prepare myself for a future job career | 0.05882 | 0.57087        | 0.42913      |
| Q. Less difficult Learning System to access and use                      | 0.05882 | 0.59072        | 0.40928      |
| **Total score**                                                          |        | 0.61198        | 0.38802      |

After the survey and assessment process were carried out, it can be seen in Table 2 that the priority vector values for each criterion and each learning system with the COVID-19 context 19. Students were asked which learning system was better, when the pandemic was ongoing, by explicitly conveying the conditions of COVID-19.

For each criterion, the respondent prefers the online learning system when the respondent is given the COVID-19 context. The criteria with the highest score are easiness to use and easiness to learn. The two criteria are superior in both Table 1 and Table 2. In the condition of COVID-19, respondents
considered that the online learning system was easier to use and easier to learn than face-to-face learning systems. It can be interpreted that these two criteria are very important and relevant in the learning system. In addition, this value can be interpreted that face-to-face learning systems are generally easier to use and easier to learn. However, in this pandemic condition, all these conveniences are lost and are less important than safety and security.

Table 2. Perception of the Best Learning System with the Context of Covid-19

| Criteria                                                                 | Weight | On Class Meeting | Online Class |
|--------------------------------------------------------------------------|--------|------------------|--------------|
| A. Learning system that is easier to use                                 | 0.05882 | 0.40928          | 0.59072      |
| B. Learning system that is easier to learn                               | 0.05882 | 0.40928          | 0.59072      |
| C. Learning system that is easier for me to become skilled at using it   | 0.05882 | 0.42913          | 0.57087      |
| D. Learning system which further enhances my learning performance        | 0.05882 | 0.46946          | 0.53054      |
| E. Learning system that will increase productivity and academic work     | 0.05882 | 0.44921          | 0.55079      |
| F. Learning system that makes it easier for me to learn lesson content    | 0.05882 | 0.44921          | 0.55079      |
| G. Learning system is better in my opinion                               | 0.05882 | 0.46946          | 0.53054      |
| H. A more discreet Learning System to use                                | 0.05882 | 0.44921          | 0.55079      |
| I. Learning system that I have a more positive attitude towards          | 0.05882 | 0.44921          | 0.55079      |
| J. The Learning System which more motivates me to view announcements and information frequently | 0.05882 | 0.44921          | 0.55079      |
| K. Learning system that encourages me to use more diligently             | 0.05882 | 0.44921          | 0.55079      |
| L. A Learning System that makes me feel confident that I will find the information I need | 0.05882 | 0.42913          | 0.57087      |
| M. My Learning System has the necessary skills to use                    | 0.05882 | 0.46946          | 0.53054      |
| N. Learning systems are more important to me as a student                | 0.05882 | 0.44921          | 0.55079      |
| O. The Learning System that I feel more comfortable using because it fits my values and culture as well as the values and culture of the community | 0.05882 | 0.44921          | 0.55079      |
| P. My preferred Learning System I prefer In order to prepare myself for a future job career | 0.05882 | 0.44921          | 0.55079      |
| Q. Less difficult Learning System to access and use                      | 0.05882 | 0.44921          | 0.55079      |
| **Total score**                                                          |        | **0.4445**       | **0.5555**   |

However, questions related to necessary skills did not reappear to be the highest score winner in Table 2. It can be interpreted that respondents, in a state of being trapped in the COVID-19 pandemic, are struggling enough to take advantage of the online learning system and realize that their skills are
not sufficient. So that respondents are not confident enough to state that they have sufficient skills in using the online learning system.

This shows that the motivation to use an online learning system has increased due to urgency in the midst of the COVID-19 pandemic. This motivation was accompanied by insufficient skills. If a learning facility is provided to train online learning skills, it will be a useful thing for teaching participants.

![Rich Picture of Integrated System](image)

**Figure 1. Rich Picture of Integrated System**

Figure 1 shows the gap of the priority vector between the first questionnaire and the second questionnaire. Respondents answered the same question twice. For the first time, respondents were not given the context about COVID-19. Whereas in the second process, respondents were given context about COVID-19. There was a change in the respondent's answer to the same question. During the first questionnaire, respondents stated that the face-to-face learning system was better, while in the second questionnaire respondents stated that the online learning system was better.

The change in value does not only occur in the total value but also occurs in detail in the value of each criterion. Figure 1 shows the change in these values for each criterion using a radar chart. It can be seen that the most drastic changes occurred in the first and second questions, namely about ease of use and ease of learning. This is in line with the explanation in Table 1 and Table 2, where the two criteria get the highest score for the two questionnaires, of course it creates a large gap in value changes as well.

The criteria that experienced the lowest change in value were "Learning systems are more important to me as a student". There was no significant change between the first questionnaire and the second questionnaire for this indicator. It can be interpreted that for respondents, the most important learning system is face to face. Online learning systems cannot be reliable systems.

4. **Conclusion**

In the Indonesian context, at least within the scope of the respondents of this study, the online learning system has not become the main system in the learning process. There are several means that have spread in this online learning system. However, face-to-face learning systems are still the main choice for teaching participants.

This COVID-19 condition forces the learning process to be carried out online. This has led to a change in the perception of respondents about which learning system is better to use. The resistance
that arises against online learning systems turns into forced acceptance. However, this acceptance was accompanied by an awareness that the skills needed to use the online learning system did not yet exist. Some further research can be done. Other research methods can be used in evaluating the use of this online learning system technology. In addition, the use of more developed processing methods such as Fuzzy AHP, AHP Topsis, and other AHP variations can be used.

References
[1] Bao W 2020 COVID-19 and online teaching in higher education: A case study of Peking University Hum. Behav. Emerg. Technol.
[2] Chiodini J 2020 Online learning in the time of COVID-19 Travel Med. Infect. Dis.
[3] Schneider S L and Council M L 2020 Distance learning in the era of COVID-19 Arch. Dermatol. Res.
[4] Dhawan S 2020 Online Learning: A Panacea in the Time of COVID-19 Crisis J. Educ. Technol. Syst.
[5] Allo M D G 2020 Is the online learning good in the midst of Covid-19 Pandemic? The case of EFL learners J. Sinestesia
[6] Verawardina U 2020 Reviewing online learning facing the Covid-19 outbreak Talent Dev. Excell.
[7] Agarwal S and Kaushik J S 2020 Student’s Perception of Online Learning during COVID Pandemic Indian J. Pediatr.
[8] Abidin Z, Rumansyah and Arizona K 2020 Pembelajaran Online Berbasis Proyek Salah Satu Solusi Kegiatan Belajar Mengajar Di Tengah Pandemi Covid-19 J. Ilm. Profesi Pendidik.
[9] Zayabalaradjane Z 2020 COVID-19: Strategies for Online Engagement of Remote Learners. Online Submiss.
[10] Made Yeni Suranti N 2020 Variations of Models and Learning Platforms for Prospective Teachers During the COVID-19 Pandemic Period Indones. J. Teach. Educ.
[11] Park S Y 2009 An analysis of the technology acceptance model in understanding University students’ behavioral intention to use e-Learning Educ. Technol. Soc.