

System analysis and testing of the benefits of online learning based on madrasah e-learning on physics subjects at MAN 2 Semarang City

Muhammad Luthfi

Physics Education, Universitas Islam Negeri Walisongo Semarang, Indonesia
Email: luthfisaja085@gmail.com

Susilawati

Physics Education, Universitas Islam Negeri Walisongo Semarang, Indonesia
Email: susilawati@walisongo.ac.id

Arsini

Physics Education, Universitas Islam Negeri Walisongo Semarang, Indonesia
Email: arsini@walisongo.ac.id

Abstract. This study aims to analyze the application of online learning systems in Physics subjects and test the usability of online learning systems in Physics subjects at MAN 2 Semarang City. This type of research is descriptive qualitative. Data was collected through interviews, questionnaires, observation, and documentation. The questionnaire was created using the PIECES framework and the USE Questionnaire, modified using google forms. The research results show that implementing online learning based on e-learning madrasah has been well. All aspects, including performance, information, economics, control, efficiency, and service, show good categories. The usability test with the USE Questionnaire shows a good level of Usability or Usability in all aspects. This study indicates that the e-learning system of MAN 2 Semarang City is feasible and good to use for online learning.

Keywords: system analysis, usability test, online learning

I. Introduction

Rapid technological advances have contributed to the learning implementation process [1]. The learning process using technology, information, and communication can be the main access in learning and learning support facilities [2]. Technology-based teaching and learning activities are a manifestation of an independent learning environment, namely a learning environment that pays attention to the development of facilities, an environment that does not restrict freedom for students, provides dynamic support, and is easy to access. This technology is one of the important aspects that teachers must create to realize conducive learning in the 4.0 learning era [3].

Various innovations in media and learning models arise due to the encouragement of rapid technological developments in learning. One of the reasons behind the rapid growth of technology-based innovation is that there are obstacles in conventional or face-to-face learning methods because they can threaten health if applied during the Covid-19 pandemic. This condition raises new obstacles for the parties concerned, especially teachers. So teachers must find the right system so that learning can still run and become a solution to learning barriers during the COVID-19 pandemic. E-learning is one of the efforts made in dealing with these obstacles [3]. E-learning is a learning innovation in schools were previously learning was done conventionally and then formed into digital learning that can be accessed by the internet [4]. E-learning by language is distance learning. The word learning is often associated with education, while the word "e" (electronic) is often linked with the word "tele," "virtual," or "distance" [5]. Online distance learning systems must adapt existing systems in conventional schools into digital systems and the internet. Classes virtual that are equivalent to traditional classes in schools are the concept of online [6].

Based on the interviews with teachers, one system that can be used online and as a distance learning solution is the e-learning madrasah. Madrasah e-learning is an application created by the Madrasah Curriculum, Facilities, Institutional and Student Affairs (KSKK), which teachers and students intend to support online [7]. In the international world, e-learning is a system in the learning process, especially in universities. Of course, it will be very different if applied at the Madrasah Aliyah level, where students tend to depend on the teacher's explanations in-class face-to-face, and students listen more often [8].

System and usability tests are rarely carried out in developing and implementing the created information system. Research on system testing and usability is still considered not a major requirement in developing information systems. Developers are only focused on the problem of managing requirements. Developing e-learning as an information system or software system analysis is needed to obtain information about various obstacles that can be used for evaluation. The evaluation can improve the ability of the system and its usability to determine the usefulness of the system to users in the future. The effect is they can last a long time in its use.

Completing a complete system in its components to identify and evaluate opportunities, obstacles, problems, and anticipated needs to propose improvements to information systems based on the analysis results [9]. The method used in analyzing the system is the PIECES framework, which contains categories used to classify problems and develop solutions to those problems. This classification is sequentially divided into six categories: performance, information, economics, control, efficiency, and service [10].

Usability testing measures efficiency, ease of learning, and remembering how to interact without difficulty or error [11]. USE Questionnaire is an instrument in the form of a questionnaire package that can measure research on utilization [12]. The USE Questionnaire includes three usability aspects: efficiency, effectiveness, and satisfaction [13]. Testing usability using the USE Questionnaire is carried out to evaluate and determine whether the system will be useful, accepted by users, and last long.

Previous research on e-learning stated that e-learning in implementing distance learning during the pandemic at MIN 1 Rembang proved effective, useful, acceptable, and followed by most students [7]. The results of research related to teacher and student activities in e-learning in August 2020 showed the average percentage is above 75% in a positive direction or shows indicators of using e-learning for distance learning to increase. However, there are still some problems that need to be fixed. Then, previous research related to system analysis and usability stated that the system's usability using the USE Questionnaire guardianship application online was very good and succeeded in facilitating users in carrying out their duties efficiently [14]. Other research states that the application of the online using framework shows that the online has fully met the needs of all users, as evidenced by the average value of the level of suitability of users in all aspects of PIECES of 77.46% [15].

The basic difference between this research and previous studies is the instruments and research objects. Based on the researcher's observations, MAN 2 Semarang City was conducted online during the COVID-19 pandemic by utilizing e-learning. In the use of information systems or software development, e-learning madrasah, it is necessary to review the obstacles to make improvements according to the data and produce effective learning [16]. Then, there are many things in an application. When applied, it is necessary to do an analysis and evaluation and then review it again to see to what extent benefits learning online during the Covid-19 pandemic. So it is hoped that improvements and system development can be carried out and used optimally, including in e-learning madrasah at MAN 2 Semarang City. In this study, researchers analyzed the online-based e-learning madrasah using the Framework PIECES Questionnaire to test the system's usefulness in several indicators. So that the criteria studied are broader in scope than previous studies.

II. Materials and Methods

This research was conducted at MAN 2 Semarang City, which has used an online-based on e-learning at MAN 02 Semarang City and was born in the odd semester of the 2021/2022 academic year. This study uses a descriptive method. Qualitative research is a research method based on the philosophy of postpositivism. It's used to examine the condition of natural objects where the researcher is the key instrument. sampling data sources is carried out purposely and snowballing. Collection techniques are triangulation or combined, analysis is inductive or qualitative, and research results emphasize meaning rather than generalization [17].

The data in this study is through interview techniques, questionnaires, observation, and documentation. The interviews used in this study were unstructured interviews with respondents consisting of students, Physics subject teachers, and e-learning. Interviews were used to obtain information related to online-based e-learning

in Physics subjects at MAN 2 Semarang City, while questionnaires were used to complete the interview data. The questionnaire was designed using PIECES' framework, aided by the USE Questionnaire in compiling questions. The questionnaire was distributed to respondents online with the help of Google Forms. It is used to analyze the system and measure the usefulness of the online-based e-learning in Physics subjects at MAN 2 Semarang City.

In this study, the sampling technique used is purposive sampling, namely the technique of determining the sample by choosing from among people who are considered to know best about what the researcher expects, making it easier for researchers to dig up information from the object/social situation being studied [17]. The sample selection in this study was under the direction of the school, namely grade 11 MIPA MAN 2 Semarang City, amounting to 130 due to consideration E a deeper understanding of -Learning Madrasah from these students.

Qualitative research must reveal objective truth. Therefore the validity of the data in qualitative research is very important. In qualitative research, the validity test uses the term data validity test [17]. To test the validity of the data, the researchers conducted a triangulation technique by comparing the data from interviews with the data from questionnaires and observations. Data from these three sources are then described and categorized, which ones are the same, which ones are different, and which ones are specific from the three data sources [17].

The data analysis model used in this study is a qualitative data analysis model of Miles and Huberman, which has 3 (three) stages [18]: (1) data reduction, carried out by summarizing, selecting the main things, focusing on the important stuff and look for the pattern. Thus the data that has been reduced will provide a clearer picture and make it easier for researchers to conduct further data collection and search when needed. (2) Presentation of data in brief descriptions, charts, relationships between categories, flowcharts, etc. It will be easier to present data to understand what happened and plan further work based on what is understood. (3) In Conclusion, qualitative research is a new finding that has never existed before. Findings can be in the form of a description or description of an object that was previously still vague so that after research, it becomes clear.

III. Results and Discussion

The online-based learning process, e-learning, implemented by MAN 2 Semarang City, is part of the blended learning model. The blended learning model is a learning model that refers to the combination of face-to-face learning with online which is carried out through e-learning [19]. Packages of learning resources in teaching materials and textbooks as learning media can support students' mastery of concepts [20]. E-learning MAN 2 Semarang City can be used for online, face-to-face, or blended learning. Based on an interview with one of the MAN 2 Semarang City students, Bagas said that the blended learning at MAN 2 Semarang City was carried out with the intensity of face-to-face learning once in three weeks. (Bagas, interview 18 September 2021).



Figure 1. Examples of Features Available in e-learning MAN 2 Semarang City

Preparing online-based e-learning at MAN 2 Semarang City begins with the teacher filling out Core Competencies and Basic Competencies and uploading learning materials a week before learning begins. The results of an interview with one of the physics teachers, Fauzan, said that after the learning process began, the uploaded teaching materials would be explained by the teacher via video. After that, students are invited to discuss the material being discussed. If there is no clear material, students are welcome to ask questions. (Fauzan, interview 11 September 2021).

After the material in one KD is complete, the teacher will give assignments to measure the extent of student understanding. The assignment is carried out online through madrasah e-learning. E-learning madrasah provides two features for sending assignments, namely KI3 for knowledge assignments and KI4 for skills assignments. Through the KI3 and KI4 features, teachers can give feedback in assessments and comments (Bagas, interview 18 September 2021).

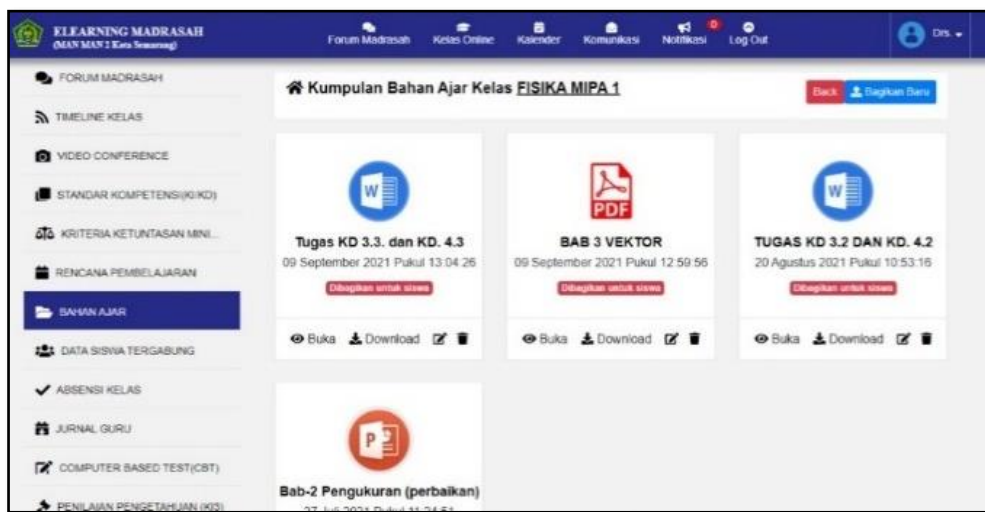


Figure 2. Examples of materials that have been uploaded to the e-learning MAN 2 Semarang City

Evaluation of learning in Physics subjects at MAN 2 Semarang City includes daily assessments, mid-semester assessments, and end-semester assessments. Learning evaluation is carried out to measure the achievement of the material that the teacher has taught. The learning assessment is conducted online through an e-learning madrasah utilizing the CBT (Computer Based Test) feature. In this feature, the teacher can make questions in multiple-choice, matchmaking, false and true, short answers, and descriptions. With this feature, the system will carry all automatic assessments with the provisions of the question scores that the teacher has pre-arranged.

Based on the results of research that has been carried out, researchers found data about the analysis online based on e-learning madrasah in Physics subjects at MAN 02 Semarang City. The system analysis questionnaire was designed using a framework that was processed according to the descriptive statistical analysis method. The scoring results for all aspects are as follows:

Table 1. Average Distribution of Each Aspect of System Analysis Using Framework PIECES

| No | Indicator | Average | Description |
|----|-------------|---------|-------------|
| 1 | Performance | 3.23 | Good |
| 2 | Information | 3.25 | Good |
| 3 | Economic | 3.23 | Good |
| 4 | Control | 3.26 | Very Good |
| 5 | Efficiency | 3.19 | Good |
| 6 | Service | 3.26 | Very Good |

In the table above, it can be seen that the scoring results obtained for each aspect of the e-learning MAN 2 Cities Semarang uses framework PIECES. The results of these aspects are as follows:

1. Performance

The performance score of e-learning MAN 2 Semarang City is 3.23, which shows the performance of the e-learning MAN 2 Semarang City in Physics subjects has been going well. This result is because, based on the results of the comments column in the questionnaire, the e-learning MAN 2 Semarang City features are complete. After all, they have supported learning activities from preparation to learning evaluation. Some commented on the features in their e-learning MAN 2 Semarang City has a unique icon, so it is easy to understand. However, based on the results of the questionnaire data processing, it was found that the response time factor had the lowest average score. Although the score is still on a fast scale, these factors are quite influential in determining the performance of a system. The problem of response time speed can be caused by the performance of the website itself or caused by the user's connection.

2. Information

The e-learning MAN 2 Semarang City score is 3.25, which indicates a good category. This result is because the outcomes of the questionnaire comment column state that e-learning makes it easier for students to understand information and assignments from the teacher. This result is relevant to an interview with one of the physics teachers who stated that the information provided by e-learning madrasahs was very helpful, especially for new users. The e-learning madrasah will provide instructions on the function of each feature for new users. In addition, there are also video tutorials on the front page of the e-learning official madrasah. However, some students stated that the information provided by e-learning at MAN 2 Semarang City was inaccurate. This inaccurate information is because some students do not understand the function of each e-learning MAN 2 Semarang City.

3. Economic

The economic score of learning is 3.23, which shows that the economic aspects of e-learning in Physics have been going well. This result is because, based on interviews with e-learning operators, Ali Said said that the Madrasah Directorate of Curriculum, Facilities, Institutions and Student Affairs(KSKK) provided free e-learning access to all madrasahs under the auspices of the Ministry of Religion of the Republic of Indonesia. The results of the comments column on the system analysis questionnaire state that e-learning makes it easier for students to collect assignments. With the features of KI 3 and KI 4, students are more efficient in managing assignments, both in terms of time and cost.

4. Control

Score control of e-learning MAN 2 Semarang City is 3.26, which shows the control of e-learning MAN 2 Semarang City on Physics subjects is very good. User data will be safe if the user maintains the confidentiality of the account and password. Although the control aspect is still on a good scale, based on an interview with one of the students, Riska said that sometimes the e-learning of MAN 2 Semarang City experienced errors, so it took a long time to access it.

5. Efficiency

Efficiency score e-learning MAN 2 Semarang City is 3.19, which indicates a good category. This result is because the results of the questionnaire comment column state that e-learning MAN 2 Semarang City is easy to use, very supportive of the learning process, and is not complicated when collecting assignments or downloading teaching materials. Physics teachers and students who were resource persons stated that e-learning has many features that help teachers maximize online learning, such as CBT features, video conferencing, KI 3, KI 4, etc. Although the efficiency aspect is still on a good scale, one physics teacher stated that the many features of e-learning madrasahs make teachers find it difficult to learn.

6. Service

The e-learning MAN 2 Semarang City score is 3.26, which shows the service from e-learning of MAN 2 Semarang City in Physics subjects is very good. However, based on the results of the comments column on the system analysis questionnaire using framework PIECES, e-learning MAN 2 Semarang City needs to be simplified again. There are too many features that confuse students in terms of their use. A different thing was expressed by a physics teacher at MAN 02 Semarang City, Fauzan, who said that it shouldn't be a problem because students can learn it independently from video tutorials on the e-learning and various sources available on the internet.

System Analysis Pattern

The system the test was carried out to determine the suitability of user needs for online-based e-learning at MAN 2 Semarang City using a framework that includes aspects of performance, information, economics, control, efficiency, and service. Based on the results of this study, the scores on all aspects did not differ much. Namely in the range of the average score of 3.19-3.26. It Shows that all elements have a quality that is not much different, both in terms of performance, information, economics, control, efficiency, and service. Which is included in the good category. So it can be said that the e-learning MAN 2 Semarang City is good for online learning. However, improvements need to be made to increase the score in several aspects. Improvements that need to be made are application performance, especially in mobile modes, such as the display of questions on the CBT feature, which is sometimes truncated. Speed response time can be caused by the web site's performance or user connection. In terms of information, the improvement that needs to be done is to add a task notification feature on the main screen on mobile devices. From an economic point of view, it will be a problem and reduce the effectiveness of learning time online if e-learning at MAN 2 Semarang City often experiences errors such as applications that come out suddenly or stop themselves. This error can be caused by the website or the connection from the user. From the control, there are no security constraints. Still, there are confidentiality constraints, such as students being able to access without permission an account that is not theirs and being able to see the results of the scores and assignments of the account owner. In inefficiency, it is necessary to simplify features, thereby increasing efficiency and ease of use. Meanwhile, there are no things that need attention in terms of service.

In addition to system analysis, researchers also conducted a usefulness test online based on e-learning madrasa subjects at MAN 02 Semarang City. Researchers used a USE questionnaire divided into four aspects: usefulness, satisfaction, ease of use, and ease of learning. The study used a Likert with a range of 1 to 4, namely: Strongly Agree (4), Agree (3), Disagree (2), and Disagree (1). The results of the assessment of the usefulness of the learning system on e-learning MAN 2 Semarang City in Physics subjects are as follows:

Table 2 Average Distribution of Each Aspect of Benefit Test Questionnaire with USE Questionnaire

| No | Indicator | Average | Description |
|----|------------------|---------|-------------|
| 1 | Usefulness | 3.06 | Good |
| 2 | Ease of Use | 3.06 | Good |
| 3 | Ease of Learning | 3.17 | Good |
| 4 | Satisfaction | 3.01 | Good |

Based on table 2, it can be seen that the score obtained from each aspect contained in the USE Questionnaire. In each aspect obtained an average score of: usability = 3.06; ease of use = 3.06; ease of learning = 3.17; and satisfaction = 3.01. If it is adjusted to each aspect of the USE Questionnaire, it can be said that the e-learning MAN 2 Semarang City used online has good value, so it is suitable for use for online learning.

The results of several observations show that there is a correlation and mutual influence between aspects of ease of use and usefulness, parameter ease of use will be followed by an increase in usefulness, and vice versa [14]. Based on table 2, it can be seen that there is a correlation and mutual influence between aspects of ease of use and usefulness. This correlation indicated a similarity in the average score between ease of use and usefulness, 3.06 with a good category. According to Aelani and Falahan, ease of use and usefulness will greatly contribute to satisfaction. Based on table 2, it can be seen that there is a correlation and relationship between aspects of ease of use and usefulness with aspects of satisfaction. This result is indicated by the quality similarity between the ease of use and usefulness aspects with satisfaction in the good category. Factor usefulness is usually less important if the system is internal, where the user is mandatory [14]. This study indicates that the user shows category, and even though the system is compulsory, as long as the system has good quality, the system still provides good usability.

IV. Conclusions

Implementing online based on e-learning madrasas in MAN 2 Semarang City has been running well. System analysis results show that e-learning at MAN 2 Semarang City is good for online learning, although several elements need improvement. The usability test results show a good level of Usability or Usability in all aspects. So it can be said that the e-learning MAN 2 Semarang City is good and feasible to use for online learning.

References

- [1] N. L. Khusniyah and L. Hakim, "Efektivitas Pembelajaran Berbasis Daring: Sebuah Bukti pada Pembelajaran Bahasa Inggris," *J. Tatsqif*, vol. 17, no. 1, pp. 19–33, Jul. 2019, doi: 10.20414/jtq.v17i1.667.
- [2] M. Misbah, W. A. Pratama, S. Hartini, and D. Dewantara, "Pengembangan E-Learning Berbasis Schoology pada Materi Impuls dan Momentum untuk Melatihkan Literasi Digital," *PSEJ (Pancasakti Sci. Educ. Journal)*, vol. 3, no. 2, p. 109, 2018, doi: 10.24905/psej.v3i2.1067.
- [3] R. Oktavian, R. F. Aldya, U. K. Indonesia, and U. T. Tunggadewi, "Efektivitas Pembelajaran Daring Terintegrasi di Era Pendidikan 4.0," vol. 20, no. 2, pp. 129–135, 2020.
- [4] A. B. Putra and S. Nita, "Perancangan dan Pembangunan Sistem Informasi E-Learning Berbasis Web (Studi Kasus Pada Madrasah Aliyah Kare Madiun)," *Semin. Nas. Teknol. Inf. dan Komun. 2019*, vol. 1, no. 1, pp. 81–85, 2019.
- [5] Euis Sofi, "Pembelajaran Berbasis e-learning Pada Mata Pelajaran Sejarah Kebudayaan Islam Kelas viii Madrasah Tsanawiyah Negeri," *J. Penelit. Manaj. Pendidik.*, vol. 1, no. 1, pp. 49–64, 2016.
- [6] A. Mayub, *E-Learning Fisika Berbasis Macromedia Flash MX*. Yogyakarta: Graha Ilmu, 2005.
- [7] S. Hikmah, "Pemanfaatan E-Learning Madrasah Dalam Pelaksanaan Pembelajaran Jarak Jauh Masa Pandemi di MIN 1 Rembang," *J. Pendidik. dan Pelatih.*, vol. 4, 2020.
- [8] A. B. Husnul Khotimah, Husniyatus Salamah Zainiyati, Abdulloh Hamid, "E-learning application Madrasah online learning solution in the middle of pandemic Covid-19 in Ma Negeri Insan Cendekia, Kendari," *Tech. Soc. Sci. J.*, vol. 10, 2020.
- [9] J. E. K. Kenneth E. Kendall, *Systems Analysis and Design*, 5th ed. Jakarta: Indeks, 2011.
- [10] L. L. Whitten, Jeffrey, & D. Bentley, *System Analysis & Design Methods Seventh Edition*. New York: McGraw-Hill, 2007.
- [11] A. N. Badre, *Shaping Web usability: interaction design in context*. Boston: Addison-Wesley, 2002.
- [12] S. Yuniarto, "Usability Dalam User Experience Pada Penggunaan Sistem Informasi Rumah Sakit Gigi dan Mulut UMY," UMY, 2018.
- [13] G. I. Marthasari and N. Hayatin, "Analisis Usability Terhadap Sistem Lective Gegulang," in *Jurnal Seminar Nasional Teknologi dan Rekayasa (SENTRA)*, 2017, vol. 1, no. 1, pp. 1–8.
- [14] K. Aelani and Falahah, "Pengukuran Usability Sistem Menggunakan Use Questionnaire," *Semin. Nas. Apl. Teknol. Inf. 2012 (SNATI 2012)*, vol. 2012, no. Snati, pp. 15–16, 2012.
- [15] M. Danuri, "Evaluasi Penerapan Media Pendidikan Diskusi," in *Proceeding Seminar Nasional Science and Engineering 2016*, 2016, vol. 2, no. Sens 2, pp. 137–145, [Online]. Available: <http://prosiding.upgris.ac.id/index.php/sens2/sens2/paper/view/1143/1095>.
- [16] O. Hamalik, *Kurikulum dan Pembelajaran*. Jakarta: Bumi Aksara., 2009.
- [17] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. Bandung: PT. Alfabeta, 2016.
- [18] M. Saldana and Huberman, *Qualitative Data Analysis*. America: SAGE Publications, 2014.
- [19] S. Sudarman, "Pengaruh Strategi Pembelajaran Blended Learning Terhadap Perolehan Belajar Konsep Dan Prosedur Pada Mahasiswa Yang Memiliki Self-Regulated Learning Berbeda," *J. Pendidik. dan Pembelajaran*, vol. 21, no. 1, pp. 107–117, 2014.
- [20] S. Susilawati, P. Pramusinta, and E. Saptaningrum, "Penguasaan Konsep Siswa Melalui Sumber Belajar e-Modul Gerak Lurus dengan Software," *Unnes Phys. Educ. J.*, vol. 9, no. 1, p. 8, 2020.