

How is the Quality of E-Learning Developed by Mathematics Perspective Teachers?

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Abstract. This study aims to examine the quality of 8 e-learning design developed by perspective mathematics teachers. The instrument used was an observation sheet consisting of 25 dimensions observed related to 6 fields, namely tutor support, collaboration, technology, information transparency of provider/course, course structure, and didactics. The results of this study indicate that of the 8 e-learning designs developed, most of the designs have met all the aspects in each field. However, the design left out the Individualized Learner Support since the designed e-learning is only focused on the particular topic on mathematics and the support needed beyond the topic is provided by teacher through other form such as class WhatsApp group in where students and teachers interaction are not limited only on the particular topic. Another aspect left out is Traditional Communication Media since it already covered by more sophisticated media like video conference, google drive and WhatsApp. Organisational Information is not yet paid attention in the designing the e-learning which could be added for better information on the course detail. Regarding the discursive cooperation and discussion, all the 8 designed e-learning provide the problem to be discussed but only 6 out of 8 of the designed e-learning promote classroom discussion with discursive problem.

Keywords: e-learning design quality, mathematics perspective teachers, e-learning development.

1 Introduction

Since we entered the industrial revolution 4.0, all sectors inevitably led to it. Education which was previously traditional, which was carried out in physical classes, shifted to virtual classes. Therefore, the learning process is required not only limited to space and time, but a more flexible learning design is needed in this 4.0 industrial revolution. The need for this kind of learning is increasingly needed due to the Covid-19 pandemic that has hit the whole world from 2019 to the present (Rahman et.al., 2020). These two strong reasons trigger the numerous practices of electronic learning (e-learning).

E-learning, according to OECD (2005) is defined as the use of information and communication technologies in education includes the usage of information and communication technology as a complement to traditional classrooms, online learning or mixed modes. Tsai et.al. (2013) defined e-learning as a teaching and learning approach which utilize electronic media and devices for communication, interaction, and training, to facilitate implementation of innovative ways of understanding and developing learning. Meanwhile, after collecting and extracting several definitions of E-learning, Islam et.al (2021) conclude e-learning, which also known widely as online learning, online distance learning, or web-based learning, as incorporates

information and communication technologies that are either web-based, web-distributed, or web-capable that disseminates and enables global access to online learning/teaching resources in the form of network courses in many ways. Many definitions of e-learning had suggested by some researchers. Some of the them refer to e-learning as providing complete on-line courses (Arkorful, 2014).

The practice of e-learning in Indonesia during the pandemic is done by various tools and devices. One common tool used is WhatsApp. Most of teachers preferred to use this application as a tool for conducting online learning in covid-19 Pandemic (Sukma & Priatna, 2021). Although this application cannot be used for all forms of e-learning, it is the most accessible application for both teachers and students in Indonesia. Electronic learning is not a new thing. This kind of learning has been promoted for more than 20 decades. However, the practice of e-learning still has pros and cons for teachers, even though there's an opinion that the product of e-learning especially student achievement and conceptual understanding is not as good as the result of the students who learn in the real classroom. Both teachers and students admitted difficulties with this e-learning setting. This is because the practice of e-learning that is applied does not pay attention to certain criteria related to the quality of good e-learning.

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Quality in e-learning is understood in two contexts, they are the quality of teaching and learning process through e-learning and the quality of the e-learning itself (Teodora et al., 2013). As for the quality discuss on this study id the second one. To give meaningful learning and fruitful result, an e-learning should meet some criteria. Ehlers (2004) require 7 fields of quality of e-learning design, namely tutor support, collaboration, technology, costs-expectations-benefits, information transparency of provider/course, course structure, and didactics.

It is no doubt that e-learning will be continued to be developed and used by more and more teachers as needed following the development of technology and since almost all the teachers have experienced it. Thus, as a preservice teacher, he must have the knowledge to develop good e-learning. The study on how to develop e-learning is not a few, however, not many of them focus on assessing the quality of the designed e-learning, especially for mathematics preservice teachers. This study is aimed to unpack the quality of the mathematics e-learning designed by mathematics preservice teachers. Thus, we can know whether we have a representative sample of a good e-learning design on mathematics.

2 Research Method

This is a qualitative study that aims to assess the quality of 8 mathematics e-learning designed by preservice teachers. The instrument used was an observation sheet consisting of 25 dimensions observed related to 6 fields, namely tutor support, collaboration, technology, information transparency of provider/course, course structure, and didactics that compiled by Ehlers (2004) excluding costs-expectations-benefits since the e-learning is purposively designed to be used with the teacher guidance and synchronously used. Prospective teachers are given the task of developing a design of e-learning, in groups. The results of the designs are then examined and observed using an observation sheet by Ehlers (2004) minus one field. After the data is collected, then the results are analysed then coding and data reduction are carried out, to draw conclusions.

3 Result

A group assignment to design e-learning on a mathematics topic is given to mathematics preservice teacher preceded by a task to develop a lesson plan. As the result, there are eight mathematics e-learning design on eight different mathematics topics: Numbers, Set, Algebra, system of linear equations, Ratio and proportion, lines, segment, angle and its relation, social arithmetic, quadrilateral and triangle. All the eight e-learning are developed by employing Google Classroom as the learning management system. One of the reasons stated by the preservice teacher is because Google classroom is easy to use, developed and navigated and has cloud storage system.

To measure the quality of the designed e-learning, Ehlers (2004) framework on the quality assurance aspects of an e-learning is used. The e-learning is

purposively designed to be used synchronously and with the present of the teacher to learn a particular topic in mathematics. Thus, the 4th quality field: costs-expectations-benefits on the Ehlers (2004) is not used to evaluate the quality of the designed e-learning. Table 1 shows the result on the quality assurance of the designed e-learning.

Table 1. The quality assurance of the designed e-learning based on Ehlers' six quality fields (Ehlers, 2004)

Quality Field	Dimension	D 1	D 2	D 3	D 4	D 5	D 6	D 7	D 8	Total
Quality Field 1: Tutor Support	Dimension 1: Interaction Centeredness	✓	✓	✓	✓	✓	✓	✓	✓	8
	Dimension 2: Moderation of Learning Processes	✓	✓	✓	✓	-	✓	✓	✓	7
	Dimension 3: Learner vs. Content Centeredness	✓	✓	✓	✓	-	✓	✓	-	6
	Dimension 4: Individualized Learner Support	-	-	-	-	-	-	-	-	0
	Dimension 5: Goal- vs. Development Centeredness	✓	✓	✓	✓	-	✓	✓	-	6
	Dimension 6: Traditional Communication Media	-	-	-	-	-	-	-	-	0
	Dimension 7: Synchronous Communication Media	✓	✓	✓	✓	✓	✓	✓	✓	8
	Dimension 8 : Asynchronous Communication Media	✓	✓	✓	✓	-	✓	✓	✓	7
Quality Field 2: Cooperation and Communication in the Course	Dimension 9: Social Cooperation	✓	✓	✓	✓	✓	✓	✓	✓	8
	Dimension 10: Discursive Cooperation	✓	✓	✓	✓	-	✓	✓	-	6
Quality Field 3: Technology	Dimension 11: Adaptivity and personalization	✓	✓	✓	✓	✓	✓	✓	✓	8
	Dimension 12: Synchronous Communication possibilities	✓	✓	✓	✓	✓	✓	✓	✓	8
	Dimension 13: Availability of contents (technical)	✓	✓	✓	✓	✓	✓	✓	✓	8
Quality Field 5: Information	Dimension 19: Counselling, Advise	✓	✓	✓	✓	✓	✓	✓	✓	7

transparency	Dimension 20: Organizational Information	-	-	-	-	-	-	-	-	0
	Dimension 21: Information About Course Goals & Contents	✓	✓	✓	✓	✓	✓	✓	✓	8
Quality Field 6: Course structure	Dimension 22: Personal Support of Learning Processes	✓	✓	✓	✓	✓	✓	✓	✓	8
	Dimension 23: Introduction to Technical Aspects & to the Content	✓	✓	✓	✓	✓	✓	✓	✓	8
	Dimension 24: Tests and Exams	✓	✓	✓	✓	✓	✓	✓	✓	8
Quality Field 7: Didactics	Dimension 25: Background Material	✓	✓	✓	✓	✓	✓	✓	✓	8
	Dimension 26: Multimedia Enriched Presentation Material	✓	✓	✓	✓	-	✓	✓	-	6
	Dimension 27: Structured and Goal Oriented Course Material	✓	✓	✓	✓	✓	✓	✓	✓	8
	Dimension 28: Support of Learning	✓	✓	✓	✓	✓	✓	✓	✓	8
	Dimension 29: Feedback on Learning Progress	✓	✓	✓	✓	✓	✓	✓	✓	8
Dimension 30: Individualized Tasks	✓	✓	✓	✓	✓	✓	✓	✓	8	

3.1 Quality Field 1: Tutor Support

In the field of tutor support, all the design shows that it at least considered one students' tutor support preferences which is dimension interaction centeredness. This dimension relates to communication and interaction between the teacher and the learner in which it is done in bi-directional interaction (Figure 1) especially related to the support performance in the form of feedback. This form of support performs by the teacher in the designed e-learning is mostly facilitated by utilized the "comment" and the "private comment on the assignment" in the Google Classroom. In some designs, it also be done by WhatsApp or video conference tool like Google meet and zoom.

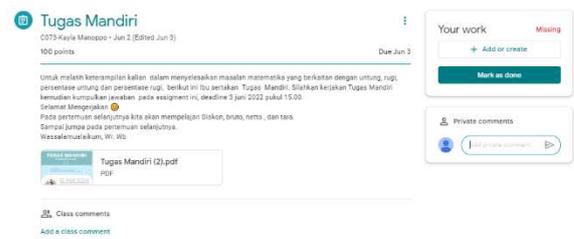


Fig.1 Teacher support on e-learning

Six out of eight design are even considering and facilitated all the dimension of learners' preference towards the communication and cooperation with the teacher in the online learning except for the Individualized Learner Support. This is because the designed e-learning is only focused on the particular topic on mathematics and the support needed beyond the topic is provided by teacher through other form such as class WhatsApp group in where students and teachers interaction is not limited only on the particular topic.

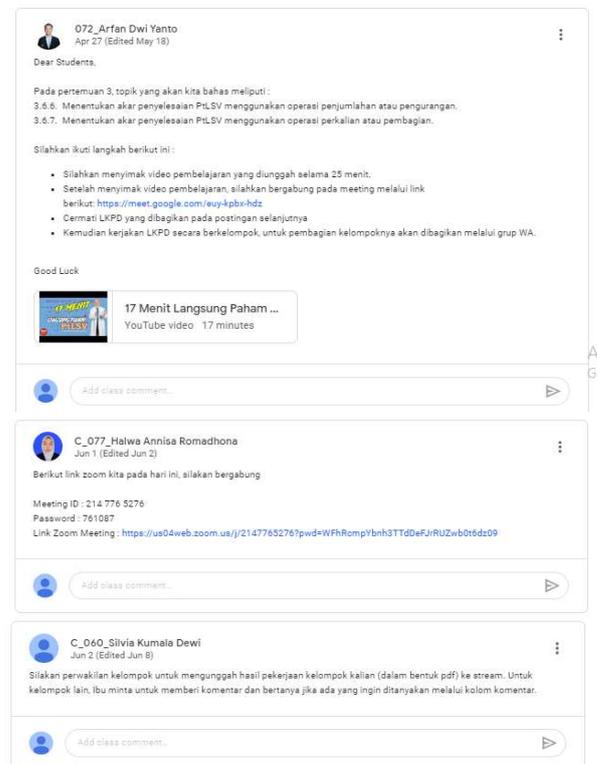


Fig. 2 The communication media used on the e-learning

As for the communication media used to contact the teacher, the designed e-learning utilize all kind of media (synchronous and asynchronous) such as comment on the Google Classroom, zoom, Google meet, and WhatsApp (Figure 2). As for the traditional one like



Telephone, Fax, Letter (mail) are not considered anymore since its function already covered by the other media and it is less familiar for the students.

3.2 Quality Field 2: Cooperation and Communication in the Course

This field contains quality requirements that learners express towards the course concerning the communication and cooperation environment with other learners in learning groups, or with teacher. As shows in the Table 1, all the designed e-learning facilitate cooperation among students, besides with the teacher.

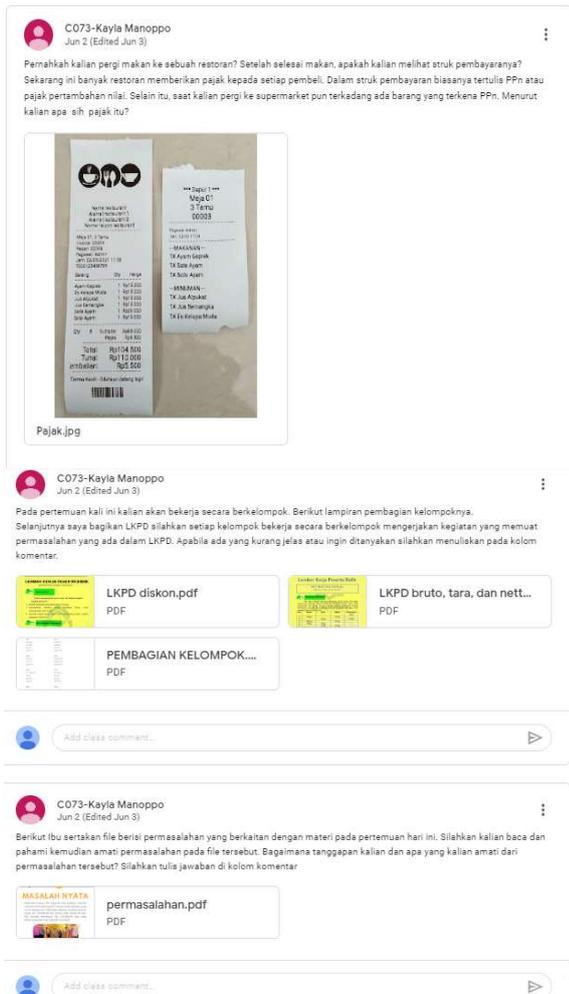


Fig. 3 Discursive cooperation facilitation in e-learning

This cooperation is facilitated by a group activity in which students have to collaborate with other and have group discussion to solve given discursive problem (6 designs) or exercises (2 designs) through given worksheet (Figure 3). The choice whether to promote discursive cooperation or not is affected by the teaching approach that is chosen by the teacher.

Group activity and discussion is conducted through WhatsApp, discussion forum build on Google Classroom (Figure 4), Google meet and or break out room zoom.

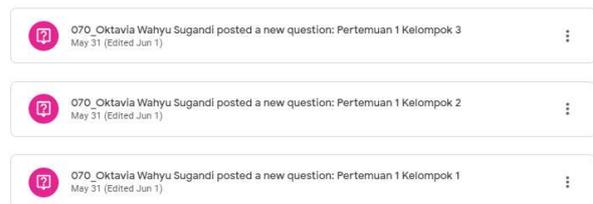


Fig.4 Discussion forum build on Google Classroom

3.3 Quality Field 3 & 4: Technology & Costs - Expectations - Value

The field of technical requirements is important for learners but also it took for granted. Google classroom LMS makes it possible for the learner to continue on their last activity without having to start over from the beginning. It also can be combined with the use of video conference media and youtube since the link can be attached to the post on Google Classroom. The learning media also can be saved through cloud storage and can be downloaded to the computer. So, in this field, all the designed e-learning met all the preferences.

The cost-value assessment of learners is one factor that determines their quality judgment of an e-learning yet it very subjective especially cost related aspects. The e-learning analysed in this study is purposively designed to be used synchronously and with the present of the teacher to learn a particular topic in mathematics. Thus, it can be assured that it has practical benefit. Thus this quality field is excluded from the measurement of quality assurance of the developed e-learning.

3.4 Quality Field 5 & 6: Information transparency & Course Structure

Another field of quality preference refers to the contains the provision of formal and standard information as well as individualized counselling on course contents, learning methodology or technical advice. All the eight e-learning provide an information related to course outline by attaching the lesson plan and welcome a question related to the course contents (Figure 5).



Fig. 5 Course information on e-learning





Fig. 6 Task and Test

However, detail information related to the assignment and assessment is not yet provided, even though that all the e-learning provide task or quiz to assess the students' learning (Figure 6). By knowing that there is a requirement to be done to get the grade actually can also motivate the students to finish the e-learning activities and give their best on it.

3.5 Quality Field 7: Didactics

Didactics quality field is the often claimed as the most considered aspects on the quality of e-learning. It covers aspects of content, learning goals, methods and materials. Since the developed of e-learning is preceded with a task to design its lesson plan, it can be assured that the e-learning activities is designed to achieve the learning goals, as well as the test and quiz. All the eight e-learning almost met all the aspects on the Didactics field, except for two design which do not attach all the materials.

4 Conclusion

The results of this study indicate that of the 8 e-learning designs developed, most of the designs have met all the aspects in each field. However, the design left out the Individualized Learner Support since the designed e-learning is only focused on the particular topic on mathematics and the support needed beyond the topic is provided by teacher through other form such as class WhatsApp group in where students and teachers interaction is not limited only on the particular topic. Another aspect left out is Traditional Communication Media since it already covered by more sophisticated media like video conference, google drive and WhatsApp. Organisational Information is not yet paid attention in the designing the e-learning which could be added for better information on the course detail. Regarding the discursive cooperation and discussion, all the 8 designed e-learning provide the problem to be discussed but only 6 out of 8 of the designed e-learning promote classroom discussion with discursive problem. This is affected by the teaching approach that is chosen by the teacher. As for the didactic, make a e-learning

lesson plan as preceded task really help to assure the quality of the developed e-learning on the Didactic Field.

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