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MEASUREMENT OF STUDENT MATHEMATICS LEARNING OUTCOMES BASED ONLINE: A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

Research on the development of e-learning learning media has grown rapidly during the COVID-19 pandemic, as has the development of valid mathematics learning outcomes tests. This article aims to review the types of platforms and forms of students' mathematics learning outcomes in online learning. It is a Systematic Literature Review research that examines articles published in 2020-2021, specifically related to the online platforms used to measure students' mathematics learning outcomes and the forms of the tests used. The conclusion of this study is that the types of platforms used include Google Form, Quizizz, Geogebra for Smartphone, Kahoot, Hot Potatoes, and Ispring Suite, while the forms of the tests are multiple choice, true-false questions, brief filled-in questions, and essay test. Based on the results of this study, it is recommended to choose a platform that is in accordance with the forms of the questions used.

Keywords: A Systematic Literature Review, Online Platform, Test

1) INTRODUCTION

The Covid-19 pandemic has had a major impact on various aspects of life, including education. Educational institutions from preschool to tertiary institutions must adapt and quickly adopt online and distance learning models that are possible to do by utilizing Information and Communication Technology (ICT) (Vijayan, 2021). The use of information technology in learning changes the tradition or culture of learning, and the learning system becomes independent (Utami, 2021). Changing face-to-face learning to online learning is the only option during the pandemic (Tsang, So, Chong, Lam, & Chu, 2021).

Distance learning during the Covid-19 pandemic, especially in mathematics, affects learning activities so that students' understanding has decreased. Distance learning causes students to tend to be passive and less interactive, thus creating limitations between teachers and students in communicating (Sitaresmi & Damayanti, 2021). During the pandemic, the distance learning process cannot be effective based on aspects of student understanding due to limited facilities (Mira et al., 2021). Educators have and continue to strive to ensure that quality and content can be delivered effectively to ensure that learning outcomes can be maximized (Vijayan, 2021). Learning outcomes can be measured by evaluating. The learning process and the evaluation of learning outcomes are also carried out online with various types of platforms.

Computer based or online evaluations are expected to provide quick and accurate evaluation results. The program can be utilized and developed to achieve educational goals

(Purba, 2020). Several platforms that can test learning outcomes include google classroom, google form, quizizz, geogebra, Kahoot, hot potatoes, and iSpring Suite. These various platforms provide convenience in implementing learning evaluations, but problems still become obstacles.

Utami (2021) explained the obstacles experienced in the implementation of online tests, namely: 1) not all students live in areas with good internet networks, 2) limited quotas owned by students, 3) difficulties in supervising student test work, 4) memory limitations of students' cell phone. Even the exam is conducted with two components, namely assignments and viva video (Bisht, Jasola, & Bisht, 2020). For this reason, this article aims to conduct a systematic literature study to find out the appropriate platform for the form of the test developed.

2) METHODS

This research was carried out using the Systematic Literature Review (SLR) stage, namely determination of Inclusion Criteria (IC), the definition of information source, literature selection, data collection, and Data Item (DI) selection. The activities carried out are summarized in the following table:

Table 1. SLR Stages

Num	Stages	Activities
1	Determination of Inclusion Criteria (IC)	• IC1: articles published in national and international journals in the period January 2020 – 2021 • IC2: articles related to the development, or implementation of measuring student learning outcomes in mathematics • IC3: the article contains the type/form of the test used • IC4: in the article, there is a test platform used
2	Definition of Information Source	Literature search was carried out on online databases, namely DOAJ and Google Scholar.
3	Literature Selection	• Use keywords: development, test, platform, and learning outcomes. • Explore and select titles, abstracts and keywords in articles obtained based on inclusion criteria • Read full or partial articles that have not been eliminated in the previous stage and determine which articles are included in the next study
4	Data Collection	Data collection is done by creating a data extraction form consisting of the author's name, year, and the contents of the article
5	Data Item (DI) Selection	• DI1: Platform used for measurement • DI2: types of tests

Furthermore, the literature selection process can be seen in the flow chart of PRISMA Flow below:

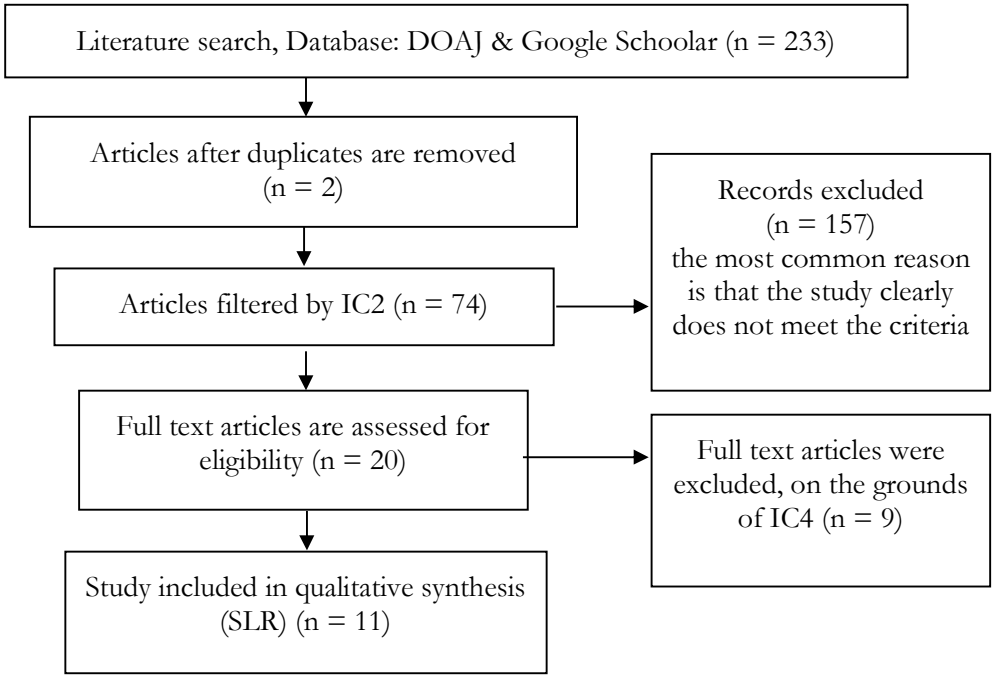

Figure 1. Data Collection Flow based on Prism Flow Diagram Format

3) RESULTS

Online learning has been implemented by schools and universities, so a tool is needed to measure the achievement of the learning. This study has found 11 relevant articles that meet the inclusion criteria. In general, forms of measurement (tests) aim to measure cognitive abilities.

Table 2. Description of the Platform and Test Forms to Measure Learning Outcomes During the Covid-19 Pandemic

Study	Author (Year/ Education Levels)	Platform	Test Form	Link
1	Puji Rahayu Ningsih, Medika Risnasari (2021/ College)	Quizizz	Multiple Choice Two-Tier Diagnostic Test	http://econference.stkip-pgri-sumbar.ac.id/index.php/matematika/itpmkeb/paper/view/1071
2	Rachmawati, Anik Kurniawati (2020/ College)	Google Form	Multiple choice, true-false, and short answer	http://jurnal.umt.ac.id/index.php/prima/article/view/1891/1446
3	Aan Subhan Pamungkas, Eka Rachma Kurniasi, Anton (2020/ College)	Geogebra for Smartphone	Essay	https://inomatika.unmuhbabel.ac.id/index.php/inomatika/article/view/160/115
4	Elvira Sundari, Nur Izzati (2020/ Senior High School)	quizizz.com	Objective Question	https://ojs3.unpatti.ac.id/index.php/barekeng/article/view/1686/2120
5	Kunuzil Jannah, Triesninda Pahlevi	Kahoot	Multiple Choice	https://journal.unesa.ac.id/index.php/jpap/article/view

Study	Author (Year/ Education Levels)	Platform	Test Form	Link
	(2020/ Vocational School)			/8172/3910
6	Devi Wulandari, Mohamad Syafi'i, & Oktavia Suwardana (2020/ Vocational School)	Quizizz dan Google Form	Multiple Choice	http://jurnal.stkipkusumanegara.ac.id/index.php/seminara2020/article/view/478/356
7	M. Ardiansyah (2020/ Senior High School)	Google Form	Multiple Choice	http://www.stkippgribl.ac.id/jurnal/index.php/lentera/article/view/674
8	Hasmita, Nasrum, A, & Herlina (2021/MTs)	Ispring Suite	Multiple Choice and true false	http://www.usnsj.com/index.php/JME/article/view/1462/pdf
9	Anggit Prabowo, Jarnawi Afgani Dahlan (2020/ Junior High School)	Quizizz	Multiple Choice	http://e-journal.hamzanwadi.ac.id/index.php/jel/article/view/2115/pdf_80
10	Arnelia Dwi Yasa, Ketut Suastika, Rr. Siti Alisa Nur Zubaidah (2020/ Primary School)	Hot Potatoes	Multiple Choice and stuffing	https://ejournal.undiksha.ac.id/index.php/JISD/article/view/23987/15403
11	Iwan Hariono, Iskandar Wiryokusumo, & Achmad Noor Fathirul (2021/ Primary School)	Google Form	Multiple Choice	https://scholar.archive.org/work/buhbekgrmvawbotm72we65nyom/access/wayback/http://journal2.um.ac.id/index.php/edcomtech/article/download/13556/pdf

Table 2 shows that the widely used platforms are Google Forms and Quizizz. While the form of the test most often used is multiple choices. In addition, the essay test can be developed using the Geogebra platform.

4) DISCUSSION

The google classroom application is an alternative platform that can be accessed via web or applications to support online learning with various facilities that make it easy for teachers not only to share material but also to collect assignments in the form of files and provide assessments, it's just that affordable internet data is needed (Ramadhani, Astuti, & Setiawati, 2019), this platform can be combined with google form. Google forms provide convenience and save time in distributing questionnaires and processing data (Batubara, 2016) and are very practical and make it easier for teachers to give grades to students (Utami, 2021).

Other evaluation platforms are Quizizz, Geogebra, Kahoot, Hot Potatoes, and iSpring Suite. Quizizz is one of the learning media in the form of games that are integrated with test questions as a form of evaluation (Mulatsih, 2020) and is carried out at the same time and can see scores and rankings on quizizz (Purba, 2017). Geogebra based smartphone is easy to use and flexible. Students can work on questions directly through their cell phones (Amalia, Purwaningsih, Widodo, & Fasha, 2020; Hallal et al., 2016; Saputra & Fahrizal, 2019). Kahoot is not only a digital assessment but also an evaluation tool for students (Cetin, 2018; Sofyana,

Faridi, & Shakiyya, 2020). Kahoot is also a game-based learning platform that can be played via a PC or smartphone, and multiple choice questions/quizzes are accessed simultaneously (Mada & Anharudin, 2019). Hot Potatoes are often referred to as a tool for making question banks to explore questions so that the question display does not appear to be watched (Susiati, Iye, & Suherman, 2019). iSpring Suite makes it easy to create interactive quizzes with three types of media, namely audio, visual, and audiovisual (Wardhono, Kalista, Kurniawati, & Susilo, 2019).

The geogebra application for smartphones can be used to solve problems, especially student worksheets in the form of description questions, so that the graphic visualization process is more real and helps students work on the questions. Another application that is often used is quizizz. Quizizz is easily accessible and provides direct assessment without a manual checking process, making it easy to determine student scores. In addition, the easy-to-access google form also provides variations in the creation of questions, not limited to multiple choice, but can also be in the form of short-form questions and descriptions. The choice of platform used cannot be separated from the type of questions to be used, so it is necessary to know the advantages and disadvantages of multiple choice questions and descriptions.

The use of multiple choice questions provides an advantage for objective testing. Multiple choice can be used for diagnostic or formative tests in various fields of knowledge, and it is easy to provide an assessment as a test of learning outcomes (Budiyono, 2018). Multiple choice tests can be checked quickly and accurately and have high results (Ibrahim & Muslimah, 2021). Multiple-choice tests have the advantage of being time-efficient and easy in terms of scoring because they are objective, but multiple-choice tests provide an opportunity for students to guess the answers. The description test has the advantage that it can be used to measure the ability of higher students and requires the ability to recall the material so that it requires integrative knowledge and good writing skills, so it takes time to implement, and there is a tendency for subjectivity in terms of assessment (Murti, Wiyanto, & Hartono, 2018).

According to Mulatsih (2020), some of the obstacles experienced during online learning are: 1) The internet network is sometimes not smooth, 2) Some students live in areas with networks that are less likely to access the internet, 3) Difficulties in monitoring the completion of student assignments, 4) It takes a long time for the teacher to correct student assignments, especially if the students is quite large, 5) The boredom experienced by students in doing online assignments independently. One of the efforts to overcome the fourth obstacle is developing an online platform-assisted learning outcome test instrument. The implication of this research is that in determining the platform to be used, it is necessary to consider the facilities and the form of the test that will be used.

5) CONCLUSION

The types of platforms used in developing learning outcomes tests include Google Form, Quizizz, Geogebra for Smartphone, Kahoot, Hot Potatoes, and iSpring Suite, while the forms of the tests are multiple choice, true-false questions, brief filled-in questions, and essay test. Specifically for the form of essay test, you can use the Geogebra platform.

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