

Analysis of the Needs Development for Multifunctional Mathematics Box Media Using QR Code

M Zainil

Universitas Negeri Padang, Jl. Prof Dr. Hamka Air Tawar, Padang, Indonesia

{melva_zainil@yahoo.com}

Abstract. This research is motivated by the need to develop innovative mathematics learning for elementary school students in the Industry 4.0 era. The purpose of this study was to determine the need for developing a multifunctional mathematics media box using QR Code for elementary school students. This research is a descriptive qualitative study using observations and questionnaires. The results showed the need for the development of a multifunctional mathematics media box using the QR Code for elementary students. The implication of this research is as a reference and foundation in the process of developing a multifunctional mathematics media box using the QR Code for elementary students.

Keywords: Multifunctional Mathematics Box Media, QR Code

1 Introduction

Entering the Industry 4.0 era resulted in the development of information and communication technologies that influence human life [1], [2]. Industry 4.0 makes information and communication technology a main driving force in various fields of life [3], [4], [5]. This is because the revolutionary era demands an efficient, digital and automatic system to open up opportunities for every individual to utilize information and communication technology in various fields of life. Information and communication technology in the Industry 4.0 era becomes a medium for human intermediaries to achieve goals, live and overcome problems faced by humans in life [6].

Learning media in mathematics learning has an important role, especially in elementary mathematics learning. The learning media functions as an intermediary to deliver information that cannot be found in the classroom [7], [8]. Learning media helps students improve understanding, present data interestingly, facilitate data interpretation and concise information [9]. It can be concluded that learning media has benefits as manipulative objects that can present the object being studied to make students understand mathematics as a whole. This is following the development of elementary school-age children with concrete learning characteristics [10], [11]. This contrasts with the abstract nature of mathematics learning. Therefore we need a bridge to connect these problems. That is where the role of learning media for elementary students to connect mathematics learning with characteristics of elementary school-age children.

One of the mathematics learning media using technology is a multifunctional mathematics media box using the QR Code. Mathematics media box is a collection of teaching aids that can be used by elementary school students in understanding mathematics learning. However, this media is still traditional therefore it needs to be developed further using QR Code so that students will use this media with a 3-dimensional system. QR code or Quick Response code is a two-dimensional image that represents a data and stores information up to 1000 character capacities [12]. The use of QR Code in learning is a good innovation for the learning system for teachers [13]. Learning by using QR code is a part of mobile learning. In general, mobile learning is learning that does not depend on place, time and students can learn independently [14]. This means that with the QR code students can access mathematics-learning material anywhere and anytime and allows them to learn actively independently.

The development of the QR Code is a new study in Indonesia, especially in the study of mathematics in elementary students. Based on the literature review conducted by researchers, it appears that several studies have been carried out such a research namely Nurmin Saleh et al entitled the use of QR code as media for foreign language learning in tertiary institutions in Indonesia[15]. This research shows that learning using QR code has a positive impact on improving the learning process. The test results showed that 63.63% of students were in an excellent category. Besides, there is a research by Bambang Sugiarto and Fuad Hasan entitled the development of an Android-based QR code scanner for the Yogyakarta Sonobudoyo museum information system [16]. From this research found that the QR code scan application built based on Android using Zbar Library has a scanner and bookmark feature. All features in this application can run well. From this research, there is no development of a multifunctional mathematics box media using QR Code for elementary school students. Therefore, the researcher wants to develop a multifunctional mathematical box media using QR Code for elementary students. However, for this research to be directed and systematic, the initial activity was to analyze the needs of this development.

2 Research Methods

This research is a qualitative descriptive study to describe, collect, analyze and conclude the findings following the research objectives. This research was conducted at Agnes Elementary School and Integrated Islamic Elementary School Marhamah, Padang City. The subjects of this study were 2 elementary school teachers and 60 elementary school students. The object of this study is the need for the development of a multifunctional mathematics box media using QR Code for elementary students. Observation method is to observe data used to provide a conclusion or diagnosis or as an act of treatment of the objectives to be achieved. Observation sheet used to describe the real conditions that appear in the field [17].

The documentation method is one way the qualitative researchers can do to get a picture from the subject's perspective through a written media and other documents written or made directly by the subject concerned [18]. This documentation method is carried out to obtain data outside the observation and questionnaire methods [19]. Data analysis technique uses triangulation. Data triangulation is a data collection technique that combines various data collection techniques (observation, questionnaire, and documentation) and existing data sources to conclude with the same results. [20]. The steps in analyzing data are a) data reduction, b) data presentation, c) Conclusion Drawing.

3 Result and Discussion

In this study, the analysis process consists of teacher analysis, student analysis and curriculum analysis..

3.1 Teacher Analysis

To clarify the results of teacher analysis, researchers divided the study into several sections, namely as follows:

a) Teacher Education

Based on the questionnaire results, 100% of elementary school teachers already have Bachelor of Primary School Teacher Education qualifications and 67% of teachers already have professional teacher certificates. This is reinforced by the results of observations and documentation in Educational Quality Assurance Council in West Sumatera saying that all elementary school teachers in Padang City have fully had Bachelor of Primary School Teacher Education. Based on the analysis, it can be concluded that elementary school teachers have fulfilled the requirements of their expertise as teachers in elementary schools so that they may develop innovation in the learning process.

b) Teacher Working Period

Based on the questionnaire results, 54% of teachers taught for 21-30 years and 46% stated that they had a working period of 11-20 years. In addition, based on observations and documentation from the Educational Quality Assurance Council, elementary school teachers have an average working period of more than 21-30 years. Based on the analysis, it can be concluded that the teacher has a working period of more than 10 years. Teacher working period influences teacher performance in class [21].

c) Teacher's Intensity in Using Mathematics Learning Media

Based on the questionnaire, 100% of teachers believed that learning media was needed in the learning process. The media used is Mathematics KIT but teacher seldom uses a media while learning. In addition, based on the observation to several elementary schools in Padang city, all elementary schools have mathematical teaching aids in a form of Mathematics KIT, but the KIT is still in traditional teaching KIT. This fact is why the development of multifunctional mathematics box media using QR Code for elementary students needs to develop. The use of instructional media is a necessity in the process of learning mathematics. Mathematics as learning related to concepts in everyday life [22][23].

d) Teacher Knowledge About Mobile Learning

Based on a questionnaire, 43% of teachers have heard the term mobile learning, 27% of them understand mobile learning and 100% of them never applied it in the mathematics learning process. This is evidenced by the documentation in lesson plans made by teachers not describing the existence of mobile learning. Based on the analysis, it can be concluded that elementary school teachers have never used mobile learning. Mobile learning is learning

following Industry 4.0 [24]. M-learning is part of e-learning using mobile devices [25][26]. M-learning is part of learning using ICT and cellular devices in the learning process [27].

e) Private Support Facilities

Based on the questionnaire, 100% of teachers have cellphones and laptops. In addition, based on surveys and documentation, every teacher has a smart phone, and many of them bring laptops to school. This proves that teachers have complete facilities in learning m-learning.

f) Computer Skills

Based on the questionnaire, 100% of teachers can operate Microsoft Word, 73.00% of teachers can operate Microsoft Excel, 63.00% can operate Microsoft Office Power Point, and 57% can operate Interactive Multimedia.

From the results above, it can be concluded that the teacher, in general, can operate applications on the computer. The development of this mathematics learning media required teacher expertise in using computers because the media is made using mobile devices such as laptops and mobile phones [28].

g) QR Code Understanding

Based on the questionnaire, 97% of teachers knew the QR code and 100% of the teachers had never used the QR Code in learning. Besides, based on observation and documentation, there was no use of the QR Code found in the administration system or the learning process system. This proves that teachers never use QR codes in the process of learning mathematics in elementary school.

h) Teacher Needs in Developing Multifunctional Mathematics Box Media Using QR Codes for Elementary Students

Based on the questionnaire, it appears elementary school teachers agreed to the development of a multifunctional mathematics media box using QR code. This proves that elementary school teachers are willing to accept learning innovations. Learning innovation is very necessary for the learning process. The innovation aims to find renewal in the education system [28][29].

Based on questionnaire analysis, observation, and documentation, the teacher is ready to develop a multifunctional mathematics media box using the QR Code for elementary school because there is no innovation made by the teacher in the mathematics learning process in elementary school

3.2 Student Analysis

To analyze student needs, researchers divide into several studies, namely as follows:

a) Student Knowledge Regarding Learning Media

Based on the questionnaire, 97% of elementary school students have learned to use learning media. Besides, based on observation, students like to use teaching aids such as Mathematics KIT in the learning process. Based on the documentation, students are more interested in learning mathematics using teaching aids rather than without using teaching aids. This proves that elementary students like learning mathematics by using instructional media. Props can improve student learning outcomes [30][31]. Besides, teaching aids can improve students' attention, affective, cognitive and psychomotor abilities [32].

b) Student Technology Skills

Based on the questionnaire, 100% of students can use smartphones and 95% can operate computers. Based on observation and documentation, students can use smartphones. The use of smartphones and laptops needs to be developed for students because in the M-learning process using QR Code students are required to operate it.[33][34].
Based on a

c) Student Needs In Developing Multifunctional Mathematics Box Media Using QR Code for Elementary Students

Questionnaire, 100% of students agreed to learn to use a multifunctional math box media using QR code. This proves that students will enjoy learning with the multifunctional math box media using QR code.

d) Student Characteristics

Based on observations, elementary students are enthusiastic in learning something related to their real lives. Also, students seem active when learning using learning media. This proves that elementary students are still in a concrete operational period. Concrete operational period is the time children learn about things related to students' real life and real objects. [36]

Based on the analysis of student needs, it was concluded that students were ready to accept and can carry out learning using multifunctional mathematical box media with QR Code.

3.3 Curriculum Analysis

Curriculum analysis by observing the material can be developed into a multifunctional mathematics media box using the QR Code. Mathematical material in elementary school consists of numbers, measurements, geometry, and data presentation [35]. Based on observation and documentation, learning material developed into learning media as below.

Table 1. Learning Material

Subject Matter	Material Description
Fraction	1. Fraction Addition 2. Fraction Substraction 3. Fraction Multiplication 4. Fraction Division 5. Comparison
Speed and Discharge	1. Calculate Unit Operations Time

Subject Matter	Material Description
	2. Speed 3. Debit
Maps and Scale	1. Maps and Direction of compass 2. Objects position on Coordinate Field 3. Scale
Cubes and Beams	Cubed and Cube root Volume of Cubes and Beams Cube and Beam Nets
Data processing	1. Collect and read data 2. Present Data 3. Interpret Data Presentation

Based on the table, a multifunctional mathematics box media using QR Code will be developed for elementary students. The material in table above will be used as a learning medium for multifunctional mathematics box media using QR Code for elementary students.

4 Conclusion

Based on research, it can be concluded that the development of multifunctional mathematics box media using QR Code for elementary students needs to be developed as a learning innovation effort in Industry 4.0.

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