Integrating technology and media into mathematics learning

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Abstract. The purpose of this study was to determine the size of developed product validation. The resulting product is interactive multimedia for learning mathematics in third class in elementary school. This development informed with the consideration that technology and learning media assist teachers in creating active, engaging, and meaningful learning. It uses in education makes learning more effective. Validator consists of media experts, linguists, and learning material experts. The instrument used is a validated questionnaire for each expert. The data were analyzed quantitatively by descriptively. The results show that the media is valid regarding media (78%), linguistic (81%), and material (80%). Indicates that the multimedia of mathematics learning for elementary school is appropriate to be used and continued to the stage of practical assessment and effectiveness.

1. Introduction
Technology and instructional media assist teachers in creating active, engaging, and meaningful learning. The emergence and development of technology can improve the effectiveness and interactivity of education [1]. However, obtaining reliable technology and instructional media is a complex task [2] for both the instructional media developers and the teachers. They need to consider various aspects of providing technology and media for students, such as students’ current knowledge, learning styles, motivation, age, optimizable sensory tools, and sociocultural circumstance [2-4]. The consideration of these aspects is dynamism technology and media in the classroom involving various types of instructional media.

Instructional media can be used at all levels of education and teaching materials both formal and informal [5], including in mathematics learning for elementary school. This mathematics learning is structured on the level of material difficulty, from the easy to difficult one and from concrete to abstract one. Mathematics for elementary school also begins with the underlying mathematical principles used during the learning process, one of which is’ Number Operation and Measurement. However, most elementary school teachers abstractly teach this material, which seems difficult for students. Meanwhile, it is very much beneficial to present to material concretely manipulating the visual cues, so it is easier for students to engage the material being studied [6, 7].

The problem of presenting concrete, accessible, and relevant material to students can be solved by using mathematics learning multimedia. Instructional media developers and teachers can improve the quality of learning by using various types of media [8], supported by multiple technologies [9]. Some criteria for choosing the excellent quality of technology and multimedia for learning are suitability to standards, outcomes and learning objectives; accurate and up-to-date information; age-appropriate language; student’s level of interest and involvement; technical quality; ease of use; inability and user
This multimedia development process follows these criteria to get the multimedia that fits the needs of the students. The most important thing is to use it appropriately, as it can increase students' interest in the lessons they are currently studying [11].

It is believed that the higher the students' interest in learning, the greater their chances of meaningful learning. Multimedia learning can present interesting and concrete learning by manipulating mathematical concepts into things relevant to students' lives. This manipulation not only increases students' understanding of concepts but also improves their positive attitudes such as attention and motivation. In multimedia learning, manipulation used is computer manipulation. It provides an interactive environment where students encounter problems of everyday life and their relation to teaching materials. Concrete experience in mathematics learning is not defined as a characteristic of the real world, but how to interpret the relationship between mathematical concepts and real situations [7]. This manipulation will possibly increase students' understanding of mathematical concepts [12, 13]. For example, for the material of number operations and measurements, students engage in meaningful learning by summing up the numbers and relating them to real life, such as summing up the books they have.

2. Method
The validation of mathematics learning multimedia for elementary school uses quantitative data analysis techniques. The done procedure is assessing the validity of mathematics teaching multimedia for an elementary school that has been designed based on students’ needs, learning objective, and facility availability analysis [14]. The assessment is assessed by expert validators of instructional media experts, language, and determining the material from Universitas Negeri Padang. The instrument used is a validated questionnaire for each expert. Then, the analyzed data is a quantitative descriptive technique.

3. Result and discussion
This research begins by contacting the validators required to assess the validity of mathematics learning multimedia for elementary school. These validators are academicians and experts from the disciplines of mathematics, primary education, instructional media and language at Universitas Negeri Padang. Figure 1 shows a validated home media page.

![Figure 1. The page of home media](image_url)
The multimedia of mathematics learning is validated by following the five steps, such as

1. Developing validation instruments
   It is the first step in validating mathematics learning multimedia for elementary school. The instrument is designed based on the principles of instructional media, mathematical concepts, and principles of learning for elementary school students.

2. Calculating instrument validity and reliability
   Before the validator uses the instruments, they estimate on the level of validity and reliability. Table 1 shows the valid and reliable test results of the tools used.

   | Instrument                                | Validity | Reliability |
   |-------------------------------------------|----------|-------------|
   | Instructional Multimedia                  | valid    | reliable    |
   | Contents of Instructional Multimedia      | valid    | reliable    |
   | Language of Instructional Multimedia      | valid    | reliable    |

3. Revising instruments
   Some invalid and unreliable items on the instruments are omitted.

4. Validator assessment of products using valid and reliable instruments
   The experts of instructional media, language, and learning material assess the feasibility of mathematics learning multimedia for the elementary school that has been developed. Each instrument is given according to the expertise of the validator. In addition to the questionnaire, the validator also provides suggestions for improvement of the developed multimedia. The recommendations are used to revise the product according to students’ input and needs.

5. Analyzing validation data
   The data from the validator are collected and analyzed using the quantitative descriptive technique. The result of this analysis is provided in Table 2. It shows that the developed multimedia is valid, so it is ready to be tested for the stages of practicality and effectiveness. The validity of multimedia learning is supported by a combination of various learning media formats including text, audio, visual, video, and model [10]. The combination offers flexible and more interactive learning so that students are interested in learning math. However, such design implies that the combination of various media formats is not significant enough to give effect to the learning outcomes because it prioritizes more on students’ interactivity [15].

   | Validator            | Assessment | Result    | Suggestion     |
   |----------------------|------------|-----------|----------------|
   | Instructional expert | 78         | Valid     | Moderate Revision |
   | Language expert      | 81         | Very Valid| Mild Revision  |
   | Learning material    | 80         | Very Valid| Mild Revision  |

This obtained validity implies the success in designing manipulation object to make it look concrete for students. The manipulation of multimedia content presentation is done by adjusting to learning objectives, combining various media formats, adapting to the content being taught, and merely displaying [16]. In particular mathematical content, this displayed manipulation helps students to connect real-world situations with mathematical symbols, work together to solve problems, discuss mathematical concepts and ideas, verbalize mathematical thinking, do the presentation in front of large groups, find ways to resolve the issues and solve mathematical problems based on teacher guidance [17-21].

4. Conclusion
   The development of mathematics learning multimedia for elementary aimed at meeting the students’ need for their interaction with technology. It is also an effort to make the mathematical concepts concrete during the learning process. This instructional multimedia test before students widely uses it.
Based on the research results, this multimedia is valid from the aspects of instructional media, content, and language use.

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