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Development of Media Authoring Tools to Improve Learning Outcomes in Mathematics Class V Elementary School

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Abstract: Education is an important aspect in the development of a nation, with the main goal of the Indonesian government to complete 9 years of Basic Education. One of the efforts to improve the quality of education is through the development of media authoring tools in learning mathematics in elementary schools. This research aims to create interactive learning media that can help grade V students understand mathematics concepts better. By using authoring tools, teachers can create interesting learning materials and make it easier for students to learn. The graduate competency standards set by the government are also a reference in the development of this media. It is expected that through the use of authoring tools, students' mathematics learning outcomes can improve significantly.

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Introduction

Education is one of the main pillars of a nation's development... One of the main goals of the Indonesian government in the field of education is to complete 9 years of basic education. Quality education will produce smart and competitive human resources (HR). To realise this vision, efforts are needed to improve the quality of education in a sustainable manner by all parties. Graduate competency standards for primary and secondary education are set through the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 21 of 2016 concerning Content Standards for Primary and Secondary Education.

It is expected that teachers as teachers can create learning activities that make students become more active, interact a lot, and can convey well to students or with teachers. Based on a journal entitled "Reflection of PISA (The Programme For International Student Assessment) Results: Improvement Efforts Based on Early Childhood Education" which states that Indonesia's position in the field of mathematics in TIMSS 2018 is ranked 73rd out of 79 countries participating in PISA.

To achieve these graduate competencies, it is necessary to establish Content Standards which are criteria regarding the scope of material and the level of competence of students to achieve graduate competencies at certain levels and types of education. Content Standards are developed to determine the criteria for the scope and level of competence in accordance with

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the competencies of graduates formulated in the Graduate Competency Standards. Mathematics learning is one of the subjects found at the elementary school to university level. Characteristics of mathematics learning. The purpose of learning mathematics is to convey ideas with symbols, tables, diagrams, or other media to clarify mathematical problems.

Some things related to the low learning outcomes of students are that teachers still carry out conventional learning by relying on textbooks available at school and still using the lecture method so that learning is teacher-centred. Meanwhile, to welcome the independent curriculum, it is expected that every teacher has implemented learner-centred learning. It can create a fun, interactive learning atmosphere so that learning becomes more meaningful. Learning media is a learning tool that becomes a tool as an intermediary used by someone to facilitate the delivery of material during the teaching and learning process, to streamline communication between teachers and students. Good learning media should be able to improve student achievement.

By utilising learning media, it can be used as one of the teacher's alternatives in teaching so that it is hoped that students can feel happy and make students not easily bored when learning takes place so that it can make it easier for students to understand and accept the subject matter provided by the teacher. In this case, the teacher must be able to harmonise between learning media and what learning methods are suitable for teaching students. Learning media is one of the means that can teach learning concepts so that the material is conveyed effectively and efficiently in order to achieve learning objectives (Sari, Ambiyar, Aziz, & Leffega, 2020).

Researchers have conducted observations in nearby schools, namely at SD Negeri 01, 03 and 04 Sidomukti. At this time, the use of media in learning has been widely applied in several schools, including at SD Negeri 02 Sidomukti. The learning media used, one of which is LCD media, and Maths props. The media has the advantage of making it easier for students to remember the lessons delivered because the delivery can be done in real time. However, it also has the disadvantage that it is static and only provides a visual display. This means students cannot interact directly with the elements on the screen or perform direct manipulation on images or graphics. Maths learning often involves manipulation, exploration and active interaction with mathematical objects.

The use of the media is still considered to be insufficient to assist teachers in delivering material, especially the basic competencies of explaining and determining the volume of spatial structures using volume units (such as unit cubes), because the material needs many examples to be easily understood. The learning process sometimes also experiences obstacles, it can be from the teacher or the media used in learning, if in learning there are still obstacles, the objectives of the learning will not be achieved optimally. In learning Mathematics, the media must be able to make students understand and understand a concept so that learning can be said to be achieved, learning Mathematics does not only teach a form of understanding that is learned by reading or listening but learning is more about how students solve an existing problem.

The mathematics learning outcomes of grade V students at SD Negeri 2 Sidomukti in the 2022/2023 academic year on the basic competencies of explaining and determining the volume of spatial buildings using volume units (such as unit cubes) are very low. Based on observations made in the learning that occurred before and interviews with the Principal or with the fifth grade teacher, it requires a change in the use of existing media at school so that learning is more innovative and varied considering the characteristics of learning

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Mathematics learning about complex concepts. With interactive multimedia, it is hoped that it can make it easier for students to receive subject matter, increase student enthusiasm for independent learning, and increase student understanding of Mathematics concepts so that students are not fixated on the concept of remembering material but understanding the material.

The following is the average value of KD mathematics knowledge in semester 1 in class V in 2022/2023 totalling 30 students with a KKM value of 70.

Table 1. Average score of KD mathematics knowledge in semester 1 in class V of SD Negeri 02 Sidomukti in the 2022/2023 academic year

No	Basic Competence	Average Value
1	Explain and perform addition and subtraction of two fractions with different denominators	64,5
2	Explain and perform multiplication and division of fractions and decimals	58,83
3	Explain the comparison of two different quantities (speed as a ratio of distance to time, discharge as a ratio of volume and time)	61,73
4	Explaining scale through plans	53,13

Source: Documentation of Class V Teacher grades SD Negeri 02 Sidomukti

Based on Table 1.1 the level of student success in learning to teach the school's predetermined KKM, where students are said to be successful in mathematics subjects if they get a score ≥ 70.There are several obstacles that cause less successful learning, where students have not been less active and motivated in the process of teaching and learning activities. Some of these obstacles are: 1) Some teachers do not have sufficient knowledge and understanding of mathematics, making it difficult to convey material in an effective and interesting way, 2). Low teaching skills and understanding of the right approach to teaching mathematics, 3) Learners tend to just memorise without really understanding the basics of mathematics which leads to not understanding the concepts, 4) Learners perceive mathematics as difficult and irrelevant to their daily lives, so they lose motivation to learn and understand mathematics concepts well.

In overcoming the problems that occur, it is necessary to design an interesting and innovative learning model. Information and Communication Technology can be utilised to create an interesting and fun learning media. Teachers must be able to develop learning media by utilising ICT. In addition to being able to use ICT as a learning resource, teachers are also required to be able to create creative and innovative learning that is integrated with ICT (Maryanti & Kurniawan, 2017). It takes a tool that makes it easy for teachers to create interactive and interesting learning content. Authoring tools are a combination of various media. Not only relying on the senses of hearing and vision, elementary school children generally learn 50% of what is heard and seen (Hikmah & Purnamasari, 2017). So that students better understand a lesson from what is seen and heard.

On this occasion, researchers will create learning media that can be used for the learning process, the learning media created by researchers is by developing authoring tools media, a software that allows users to create interactive multimedia content without the need to have in-depth programming knowledge so that students can be more involved in learning mathematics, improve understanding of concepts, and achieve better learning outcomes, the implementation of the learning process as expected can improve higher-level thinking skills

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and learning outcomes. The reason researchers use authoring tools in this learning is because authoring tools are a technology-based tool in the improvement of technology in learning mechanisms so as to bring teaching and learning practices to a new level (Naidu, 2023). Learners can be actively involved in the learning process and understand maths concepts better with features that have animation, simulation and other interactive elements.

Maths often involves abstract concepts that are difficult to understand verbally. Teachers can create tangible, easy-to-understand and engaging ways to help learners understand mathematical concepts visually by using authoring tools. For example, animations, graphs and diagrams can be used to show how variables in mathematical equations interact with each other. Project-based learning approaches, where learners are exposed to real mathematical problems and have to use their mathematical skills to solve them. Teachers can create difficult project tasks and give learners the opportunity to apply their knowledge of mathematics in a relevant context by using media authoring tools. Media authoring tools are often accessible through online platforms, allowing students to access maths learning materials from anywhere at any time, provided they have internet access. This provides flexibility in learning, allowing students to learn independently or collaborate with fellow students in a time frame that suits their needs. authoring tools can be used to create mathematics learning materials that can be tailored to the needs and ability levels of individual learners.

Teachers can structure content with varying levels of difficulty or use interactive features to provide immediate feedback to students. This helps to meet the needs of students with different learning styles and enables differentiation of learning. Authoring tools allow students to work together to solve maths problems, share ideas and provide feedback to each other. This supports collaborative learning and improves students' maths communication skills. Authoring tools are expected to be an alternative for teachers in creating an interesting animated video media on the material "Scale and Plan". Based on the background of the problems that have been stated above, this study aims to describe the application of Authoring Tools technology media to improve Learning Outcomes in research that will be developed specifically in Mathematics subjects on Scale and Plan Material for Grade V Elementary School Students.

Methods

This research uses the literarure review method to thoroughly explore the effect of digital game-based learning media to improve the psychomotor abilities of the alpha generation. There are 10 journals used by researchers, most of the research was conducted in Indonesia. The author searches journals related to the keywords Media Authoring Tools, Learning Outcomes, Mathematics, Elementary School. Journal searches were conducted using Google Scholar, Garuda Portal and Biomedcentral. The articles used used Indonesian and English full-text articles. The results of the study are interpreted in the form of a table and then a review is carried out, including the results of research and research objectives which are then analysed, looking for similarities (compare), and conducting or criticising as a reference for further development.

Research Results And Discussion

Research Results

The results of this study using keywords and some article restrictions as above, the number of articles that have been found is 10 relevant articles. All of these journals are

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related to the keywords set by the researcher. Table 1 is the result of the literature found by the researcher.

Table 2. Results of Previous Research

Author Name and Year	Review Title	Research Results
Alexander (2020)	Development of Interactive Mathematics Learning Media with Lectora Authoring Tools on the Material of Flat Side Spatial Buildings for Class VIII Students of SMPN 27 Padang.	The purpose of this research is to produce a product in the form of interactive learning media with lectora authoring tools software in the form of applications on the material of flat-sided flat-sided space building class VIII SMPN 27 padang which is valid and practical. The interactive mathematics learning media developed is valid and practical to use as media in the learning process of mathematics. The author's suggestion is that this learning media needs to be developed on other mathematics materials for use in the learning process for teachers..
Nur (2015)	Development of Animation Authoring Tool for Interactive Learning Media Creation	This research produces an animation authoring tool consisting of templates and libraries that are used by teachers to develop their own teaching materials. By integrating templates, libraries and text materials, an interactive learning media will be produced to be applied in the learning process. The final conclusion obtained from this research is based on the results of the tests carried out, the absence of errors when debugging action scripts and validation from multimedia experts, and the results of the teacher questionnaire show that this animation authoring tool can run well.
Kintoko (2015)	Development of Computer-Aided Mathematics Learning Media with Lectora Authoring Tools on the Material of Flat-Sided Spatial Buildings Class VIII SMP / MTs	The media produced is in the form of a Compact Disc (CD) and Exe-extended media that can be run on all computer operating systems. This learning media was developed using the Thiagarajan development model which includes define, design and development. The results of the development of computer-assisted mathematics learning media using Lectora authoring tools produce learning quality based on aspects of validity, practical and effective. These aspects are assessed based on material experts, media experts, mathematics teachers, peers, and students. Where this aspect shows very good results because the learning media developed is able to display learning materials with graphic animations that are easy to understand.
Bakar (2020)	Implementation of Experiment-based	Virtual laboratories play an important role as a medium that can be used in supporting and

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Author Name and Year	Review Title	Research Results
	Chemical Science Learning Using Chemcollective Virtual Lab Authoring Tool Application	anticipating the limitations of real laboratories. This service activity aims to provide practical knowledge of teacher skills in learning chemistry science practicum by applying the computer-assisted virtual program Authoring Tool Chemcollective as an alternative effort to overcome the limitations of real laboratories in schools. The training participants were science teachers at SMPIT Uswatun Hasanah in Jambi City. The methods used in this training were demonstration, practice and mentoring. The results of the activities achieved through this activity are the increased knowledge and competence of teachers about the implementation of ICT-based chemistry practicum methods. Teachers seem to be very skilled in practicing the simulations offered and even teachers also have great curiosity to try other virtual science lab simulations. This training is considered very useful because it can help teachers overcome obstacles in learning science concepts that require practicum with limited availability of tools and materials.
Kamelia (2020)	Development of Adobe Flash Cs6 Based Learning Media for Grade IV SD / MI Students	This study aims to describe the development steps and analyse the validity level of the developed learning media. In this study, the method used is the research and development method or Research And Development (R&D). According to Sugiyono (2015) "the research and development method or Research And Development is a research method used to produce certain products, and test the effectiveness of these products.
Laksamana (2022)	Development Of Interactive Learning Content Based On Authoring Tools In Hindu Religion Lessons With Blended Learning Strategy In Class X Hospitality 2 At SMK Negeri 1 Sukasada	This study aims to produce and determine teacher and student responses to the Development of Interactive Learning Content Based on Writer's Tools on Yajna Material in Hindu Religion Subjects with a Blended Learning Strategy in Class X Hospitality 2 at SMK Negeri 1 Sukasada. The method used in this research is research and development (R&D) using the Multimedia Development Life Cycle (MDLC) development model.
Kusumawati (2022)	Development of Interactive Learning Content Based on Authoring Tools in Batik Subjects for Class X	This research aims to produce interactive learning media products based on Authoring Tools in batik subjects, and find out the responses of educators and students to interactive learning media. This research is

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Author Name and Year	Review Title	Research Results
	Textile Craft Department at SMK N 1 Sukasada	research and development (R&D), with the ADDIE development model consisting of: analyse, design, development, implementation, evaluation, with the Articulate Storyline 3 application. Data collection in this study used a questionnaire instrument. The results showed for the validity test of learning content from the results of the calculation of the validation of content experts, and learning media-design getting "Very Valid" criteria.
Anggraini (2023)	Media Development of GUTOP (Fraction Calculation Operation Ladder Game) on Fraction Materials in Mathematics Subjects for Grade V Elementary School"	Learning media is still rarely developed and used by teachers in learning. Learning media has an important role in learning, because in the 21st century both students and teachers are required to have the ability to use technology, especially learning media. This study aims to determine the feasibility of the GUTOP learning media developed. The media development carried out in the form of snakes and ladders media equipped with a GUTOP mystery book. This GUTOP media contains elements of local wisdom that distinguish GUTOP media from other snakes and ladders media. The type of research used is Research and Development (R&D) using the ADDIE development model.
Saputro (2023)	Development of Cartoon Animation Media with Unity Software to Improve Mastery of Multiplication Concepts in Second Grade Students of SD Negeri Klidang Lor 01	The development of Cartoon Animation Media with Unity Software is expected to be used as an alternative media for learning mathematics, especially multiplication material at the elementary school level so that it can help instil the concept of multiplication better to students. The objectives of this research are: 1) To determine whether cartoon animation media with unity software is valid to improve mastery of the concept of multiplication of grade II elementary school students; 2) To find out whether cartoon animation media with unity software is practical to improve mastery of the concept of multiplication of grade II elementary school students; 3) To determine whether cartoon animation media with unity software is effective to improve the mastery of the concept of multiplication of grade II elementary school students in terms of student learning outcomes. This research will be carried out using the ADDIE model which

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Author Name and Year	Review Title	Research Results
		consists of five stages, namely analyse, design, development, implementation, and evaluation.
Naidu (2023)	Transforming E-Learning through Cloud-Based Interactive Multimedia Authoring Solutions.	Various tools and techniques are available to assist teachers in different levels of study, both for their respective subjects and assessments. However, the implementation of these tools and techniques is not always easy with a certain level of customisation, and therefore there are some authoring tools that provide very easy-to-implement solutions for teachers.

Discussion

The development of media authoring tools is one of the efforts that can improve mathematics learning outcomes in grade V elementary schools. Media authoring tools allow teachers to create interactive multimedia content without the need to have in-depth programming knowledge. By using interactive learning media, students can be more involved in the learning process, improve concept understanding, and achieve better learning outcomes.

Graduate competency standards for primary and secondary education in Indonesia are set through Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 21 of 2016 concerning Content Standards for Primary and Secondary Education. These content standards are criteria regarding the scope of material and the level of competence of students to achieve graduate competencies at certain levels and types of education.

The role of teachers is very important in creating effective and innovative learning activities. Teachers are expected to be able to make students more active, interact a lot, and be able to convey material well to students. In addition, teachers are also required to be able to develop learning media by utilising Information and Communication Technology (ICT). By creating creative and innovative learning that is integrated with ICT, teachers can improve students' higher order thinking skills and learning outcomes. Thus, the development of media authoring tools by teachers can be one of the solutions to improve mathematics learning outcomes in grade V elementary schools, in accordance with the competency standards of graduates set by the government, by involving the role of teachers as creative and innovative teachers in the learning process.

Conclusion

In order to improve mathematics learning outcomes in grade V primary schools, the development of media authoring tools is a step that can be taken. It allows teachers to create interactive multimedia content without the need for in-depth programming knowledge, thus increasing learners' engagement in learning and improving understanding of mathematics concepts. The graduate competency standards set for primary and secondary education in Indonesia also guide the learning process. The role of teachers is very important in creating effective and innovative learning activities, as well as utilising Information and Communication Technology (ICT) in the development of learning media. With creativity and

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innovation in integrating ICT in learning, teachers can improve students' higher order thinking skills and learning outcomes.

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