



# Android-Based Digital Teaching Materials on the Topic of Changes in the Shape of Elementary School Class V Objects

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## ABSTRAK

Bahan ajar yang tersedia di sekolah belum sesuai dengan kebutuhan siswa. Bahan ajar yang digunakan di sekolah hanya berupa salinan dari buku siswa, sehingga dalam proses pembelajaran siswa tidak mendapatkan informasi tambahan. Tujuan penelitian pengembangan ini adalah untuk mengembangkan bahan ajar digital berbasis android pada topik perubahan wujud benda kelas V sekolah dasar. Jenis penelitian yaitu pengembangan dengan model penelitian ADDIE. Subjek penelitian yaitu 2 ahli media pembelajaran, 2 ahli isi pembelajaran, dan 2 orang guru. Subjek uji coba berjumlah 10 siswa. Metode pengumpulan data yang digunakan yaitu kuesioner. Instrumen yang digunakan dalam mengumpulkan data yaitu kuesioner. Teknik analisis data yaitu analisis deskriptif kualitatif dan kuantitatif. Hasil penelitian yaitu validitas media sangat baik, validitas materi sebesar sangat baik, kepraktisan praktisi/guru sangat baik, dan kepraktisan siswa sangat baik. Hasil penelitian menunjukkan bahwa bahan ajar digital berbasis android pada topik perubahan wujud benda kelas V sekolah dasar dikategorikan layak digunakan dalam proses pembelajaran pada topik perubahan wujud benda kelas V sekolah dasar.

## ABSTRACT

The teaching materials available in schools are not for the needs of students. The teaching materials used in schools are only copies of student books so that in the learning process, students do not get additional information. The purpose of this development research is to develop android-based digital teaching materials on changing the shape of objects in grade V elementary school. This type of research is the development of the ADDIE research model. The research subjects were 2 learning media experts, 2 learning content experts, and 2 teachers. The test subjects were 10 students. The data collection method used is a questionnaire. The instrument used in collecting data is a questionnaire. The data analysis technique is descriptive qualitative and quantitative analysis. The results of the research are media validity is very good, material validity is very good, the practicality of practitioners/teachers is very good, and student practicality is very good. The results showed that android-based digital teaching materials on the topic of changing the shape of objects in class V elementary schools were categorized as suitable for use in the learning process on changing objects in class V elementary schools.

## 1. INTRODUCTION

The development of science and technology has a major impact on education. This resulted in learning activities required to use technology (Bhattacharjee & Deb, 2016; Burik, 2021; Weng & Chen, 2020). Teachers are expected to be able to use technology in learning so that learning activities can run in an innovative and fun way (Sert & Boynueğri, 2017; Weng & Chen, 2020). If learning can run smoothly and well, the learning objectives will be achieved optimally (Ledger & Fischetti, 2020; Li et al., 2018). Learning in Indonesia is expected to make students have superior resources so they can compete in the world. This causes learning activities to be considered properly by the teacher (Maatuk et al., 2021; Stender et al., 2018; Wu et al., 2022). In learning there are several components that can support learning activities such as facilities and infrastructure, learning media and teaching materials (Kurniawati et al., 2017; Yonanda et al., 2019). In the learning process, teachers and students need complete teaching materials as information providers (Nuryasana & Desiningrum, 2020). With complete teaching materials, the function of the teacher

who was previously the only source of information will shift and the teacher will be more directed to become a facilitator. (Asrial et al., 2021; Irwansyah et al., 2017; Rasmawan, 2018). On the other hand, by using teaching materials designed for student learning needs, students are also encouraged to become active learners because they can read and study the material before starting learning in class.

During the Covid-19 pandemic like this, it was felt that it was not enough to only use conventional teaching materials (printed teaching materials) because the learning process was still being carried out online. In order for each learning activity to take place optimally, teaching materials are needed that can encourage students to be more interested in and understand the material provided (Asrial et al., 2020; Cloonan et al., 2020; Seruni et al., 2020). But in reality, the teaching materials available in schools are not in accordance with the needs of students. Teaching materials used in schools are only copies of student books, so that in the learning process students do not get any additional information from teaching materials (Fisnani et al., 2020; Oksa & Soenarto, 2020). Other problems that are often faced by teachers with teaching materials include providing teaching materials that are too broad or too narrow, too deep or too shallow, the order of presentation is not appropriate, and the types of teaching materials that are not in accordance with students' abilities. (Aisyah et al., 2020; Sidiq & Najuah, 2020). Based on the results of a study of student book documents on the theme of 7th grade elementary school V on science content, especially the topic of changes in the form of objects, it was found that the material available in student books was very limited. The data from the distribution of the questionnaire supports the statement addressed to teachers and students in class V for the 2021/2022 academic year in Cluster I, Buleleng District, showing that first, 60% of teachers stated that the science content material contained in student books was narrow. Second, 60% of teachers stated that the science content material in student books was lacking in depth. This has an impact on low student learning outcomes, especially in science learning. The results of data analysis stated that 80% of teachers stated that it was very necessary to develop teaching materials and 72% of students also stated that they needed innovative teaching that could facilitate students in learning.

Based on this problem, the solution offered is to develop innovative science content digital teaching materials. This was reinforced based on the results of distributing the questionnaire which stated that 80% of teachers and 56% of students stated that they strongly agreed if the science content material in student books was developed in the form of Android-based digital teaching materials. Other research findings also state that digital teaching materials can make it easier for students to understand learning material (Astra et al., 2020; Logan et al., 2021; Rahmatika et al., 2020). Teaching materials are a very important component in learning because it is one of the learning resources that can be used by students in seeking additional knowledge or information on the material needed. (Darmaji et al., 2020; Mazidah et al., 2020; Nisa et al., 2020). Teaching materials area set of tools included learning materials, methods, limitations, and evaluation tools that are designed systematically and attractively to achieve the expected planning objectives (Komikesari et al., 2020b; Ummah et al., 2020). Teaching materials packaged in a complete design are also able to make learning activities effective and efficient because students can learn independently (Sari et al., 2020). Digital teaching materials are teaching materials developed digitally using the help of technology, communication and information (Aprilia & Suryadarma, 2020; Muzijah et al., 2020; Triwahyuningtyas et al., 2020).

With this teaching material, the function of the teacher as a facilitator will run well. Digital teaching materials will make students active because students study the material first before learning in class begins (Komikesari et al., 2020a; Purnamasari et al., 2020). This causes teaching materials to be effective in reducing the teacher's burden in providing explanations to students regarding the material to be discussed. The findings of previous research also state that Android-based digital teaching materials are effective for improving the quality of learning in the classroom, and can attract students' attention while studying. (Agustin et al., 2020; Mudiartana et al., 2021). Other research findings also state that digital teaching materials can facilitate students in independent learning (Astalini et al., 2019; Handayani et al., 2021). Other research also states that digital teaching materials can help students understand learning material so that they can improve student learning outcomes (Asrial et al., 2021; Aufa et al., 2021; Subarkah et al., 2021). There has been no study of android-based digital teaching materials on the topic of changes in the shape of objects. The advantages of Android-based digital teaching materials that will be developed are that teaching materials can be accessed via mobile phones/androids so they are very practical to learn. In addition, teaching materials are equipped with pictures, audio and video which will make it easier for students to understand learning material. The purpose of this study was to produce android-based digital teaching materials on the topic of changes in the shape of objects that are valid and practical for use in the learning process in grade V elementary schools. It is hoped that Android-based digital teaching materials can be useful and have a positive impact when used in the learning process.

## 2. METHOD

This research includes the type of research and development (research and development). The model used in this development research is the ADDIE model which consists of five stages, namely analyze, design, development, implementation, and evaluation (Pramana et al., 2020). The research subjects were 2 learning media experts, 2 learning content experts, and 2 teachers. The test subjects were fifth grade elementary school students, totalling 10 students. The data collection method used in this development research is a questionnaire method with a Likert scale instrument. The instrument used in collecting data is a questionnaire. The validation questionnaire was given to media experts and material experts. Meanwhile, a product practicality questionnaire was given to teachers and fifth grade students of elementary schools in Cluster I, Buleleng District. The questionnaire grids used in the study are shown in Table 1, Table 2 and Table 3.

**Table 1. Material Expert Questionnaire Grid**

Variable	Indicator	Instrument Item Number
<b>Content eligibility</b>	Suitability of the material with KD	1, 2, 3
	Material accuracy	4, 5, 6, 7, 8
	Material update	9, 10
	Encourage curiosity	11, 12
<b>Presentation eligibility</b>	Serving technique	1
	Presentation support	2, 3, 4, 5, 6, 7
	Coherence and coherence flow of thought	9, 10
<b>language eligibility</b>	straightforward	1, 2, 3
	Communicative	4
	Dialogic and interactive	5
	Suitability with students	6, 7
	Conformity with the rules of language	8, 9

(Modified from Asrial et al., 2021)

**Table 2. Media Expert Questionnaire Grid**

Variable	Indicator	Instrument Item Number
<b>Graphical eligibility</b>	Artistic and aesthetic	1, 2, 3, 4, 5
	Ease of navigation	6, 7, 8, 9
	Overall function	10, 11, 12

(Modified from Asrial et al., 2021)

**Table 3. Grids of the Teacher and Student Practical Questionnaire**

Variable	Aspect	Instrument Item Number
<b>Interests and Benefits</b>	Product attractiveness	1, 2, 3, 4
	Ease of use of the product	5, 6, 7, 8, 9, 10, 11, 12
	Product benefits	13, 14, 15, 16, 17, 18

(Modified from Asrial et al., 2021)

The validity of the contents of the instrument will be tested through expert judgments (judges) using the Gregory formula. The results of the research from the two experts (judges) on the android-based digital teaching material instrument grids are grouped into 2 x 2 cross tabulations consisting of columns A, B, C, and D. Data analysis methods and techniques used in this development research namely qualitative descriptive statistical analysis techniques and quantitative descriptive statistical analysis. Qualitative descriptive statistical analysis method is used to process the data in the form of responses. This quantitative descriptive statistical analysis method is used to describe the average score of each expert. In classifying the results of the validity test using the PAP convention the level of achievement is on a scale of 5 (Tegeh and Kirna, 2010).

### 3. RESULT AND DISCUSSION

#### Result

Android-based digital teaching materials on the topic of changes in the form of objects using the ADDIE model. First was analysis, at this stage there were four types of analysis carried out, namely curriculum, needs, and student characteristics. The results of the needs analysis, namely science content, especially the topic of changes in the form of objects, obtained that the material available in student books was very limited, so digital teaching materials were needed. 80% of teachers and 56 students stated that they strongly agreed if science content material in student books was developed in the form of Android-based digital teaching materials. The results of the analysis of student characteristics are that the fifth grade students of SD in Cluster I, Buleleng District, are on average 11 years old (concrete operational). The results of curriculum analysis, namely Core Competencies, Basic Competencies, and Competency Achievement Indicators that will be used are presented in Table 4.

Table 4. KI and KD used

Core Competency (IC)	Basic Competency (KD) and Competency Achievement Indicators (GPA)
3 Understanding factual knowledge by observing (hearing, seeing, reading) and asking questions based on curiosity about himself, God's creatures and their activities, and the objects he encounters at home and at school.	Analyze the effect of heat on changes in temperature and the shape of objects in everyday life Describe the properties of objects Analyze changes in the shape of objects that occur in everyday life Describe the factors that affect changes in the shape of objects in everyday life. Analyze the nature of changes in the form of objects in everyday life.

Second, the design stage (design). Android-based digital teaching materials are designed on the topic of changes in the form of objects for class V elementary school. The design stage starts from selecting application developers, designing user interfaces, designing content, and designing instruments to test product validity and practicality. The results of the flowchart design of Android-based digital teaching materials designed on the topic of changes in the shape of objects for grade V elementary schools are presented in Figure 1.

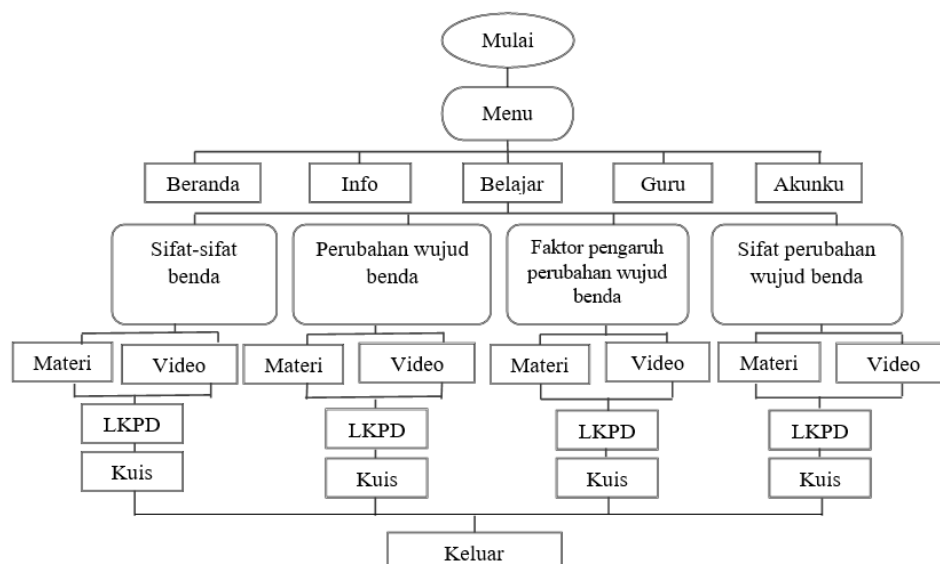
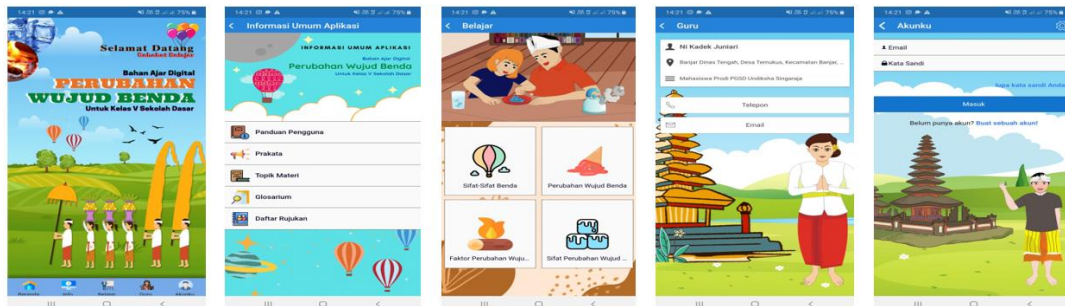


Figure 1. Digital Teaching Material Development Design Flowchart

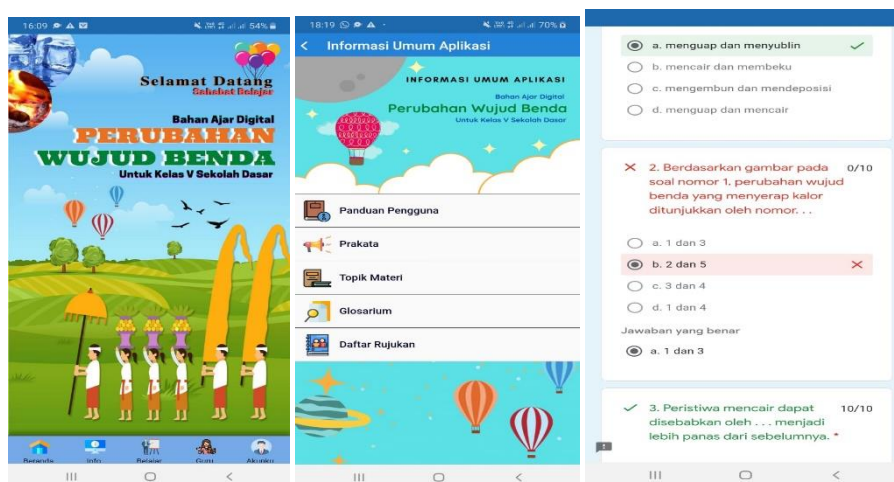
Fourth, the development stage. At this stage Digital Teaching Materials were developed in accordance with the designs that have been made before. The Android-based digital teaching material application developed is named "Learning Portal". Which is then followed by setting the template to be used and setting the logo/icon of the Learning Portal. In this application there were five main pages,

namely the home page, information page, learning page, teacher page, and my account page. on the startup page there is an image that displays illustrations of digital teaching materials on the topic of changing the shape of objects. On the learning page there are four sub-pages, namely the properties of objects, changes in the form of objects, factors for changes in the form of objects, and the nature of changes in the form of objects, each of which contains text material, learning videos, worksheets, and quizzes. The background image and icons used on each application page use an attractive animation. The interface display for Android-based digital teaching materials can be seen in [Figure 2](#).



**Figure 1.** Results of the Development of Android-Based Digital Teaching Materials

Android-based digital teaching materials were then assessed by experts. The results of the assessment given by media expert I is 98% and media expert II is 95%, the overall percentage is 96.5% so that they get very good qualifications. The assessment given by material experts I is 95% and material experts II is 97%, the overall percentage is 96% so that they get very good qualifications. The results of the practicality tests conducted by teachers and students were 96% so that they obtained very practical qualifications. It was concluded that Android-Based Digital Teaching Materials are appropriate for use in learning. The revisions given by experts are First, the color of the text on the home page. Previously, some of the text colors on the home page still didn't contrast with the background image, so the media expert gave advice to change the color of the text on the homepage so that it contrasts with the background image. Second, the layout of the user guide on the application's general information page. Third, the preface on the app's general information page. The product revision results are presented in [Figure 2](#).



**Figure 3.** Results of Revision of Android-Based Digital Teaching Materials

**Discussion**

Android-based digital teaching materials are suitable for use in learning due to several factors. First, Android-based digital teaching materials make it easier for students to understand learning material. Teaching materials in the learning process can grow and enhance student creativity (Asrial et al., 2021; Triwahyuningtyas et al., 2020). Other research findings also state that digital teaching materials can make it easier for students to understand learning material (Astra et al., 2020; Logan et al., 2021; Rahmatika et al., 2020). Teaching materials are a very important component in learning because they are learning resources that can be used by students in seeking knowledge of learning materials (Darmaji et al., 2020; Mazidah et al., 2020; Nisa et al., 2020; Subarkah et al., 2021). With complete teaching materials, the

teacher's function is directed to become a facilitator (Asrial et al., 2021; Irwansyah et al., 2017; Rasmawan, 2018). Use teaching materials designed for learning needs make students active because they can read and study the material before starting learning in class (Aufa et al., 2021). This certainly makes it easier for students to understand learning material quickly.

Second, *Android-based digital* teaching materials are appropriate for use in learning because they are very practical and easy. The existence and progress of Android in the current era of global communication has provided opportunities for interaction between teachers and students, between fellow students, and between students and learning resources that can be done anytime and anywhere, without being limited by space and time. (Afriyanti et al., 2021; Hadiyanti et al., 2021; Logan et al., 2021). In addition, with the help of Android, the process of providing and presenting learning materials and ideas can be more interesting and fun (Asrial et al., 2020; Ningsih & Mahyuddin, 2021). The application of Android-based teaching materials as learning media is the right alternative to using technology to improve the quality of education. Teaching materials Android-based has several advantages over other teaching materials, including: first, it can be used anytime and anywhere (Ahdan et al., 2020; Jazuli et al., 2018). The practicality of using digital teaching materials also increases student learning motivation.

Third, *Android-Based Digital Teaching Materials* are appropriate for use in learning because they increase student enthusiasm for learning. Android-based digital teaching materials are designed with animated images and attractive icons. Teaching materials that display interesting pictures can make students motivated and more interested in learning (Afifah et al., 2016; Cloonan et al., 2020). Therefore, with the presence of quality and interesting teaching materials, it will have an impact on student learning activities, interests, to creativity which improves student learning outcomes. Teaching materials packaged in a complete design are also able to make learning activities effective and efficient because students can learn independently (Istuningsih et al., 2018; Sari et al., 2020). Digital teaching materials use technological assistance to increase student enthusiasm in learning (Aprilia & Suryadarma, 2020; Muzijah et al., 2020; Triwahyuningtyas et al., 2020).

Previous research findings state that digital teaching materials that are developed as attractive as possible will make it easier for students to understand learning material (Liu et al., 2021; Neppala et al., 2018). Other research findings also state that using digital teaching materials can improve student learning outcomes (Astalini et al., 2019; McNamara et al., 2020). Other research also states that digital teaching materials can increase student motivation (Handayani et al., 2021; Irwansyah et al., 2017). So, it can be concluded that digital teaching materials can help students learn and are able to increase motivation and student learning outcomes. The limitation of this research is not to test the effectiveness but it can be used because it gets very good qualifications. The limitations of this research are up to validity but still feasible to use because they get very good qualifications. The implication of this research is that the digital teaching materials developed can be used by teachers in learning. In addition, the digital teaching materials developed foster student curiosity, encourage students to study more enthusiastically, and learn independently, so that learning objectives can be achieved optimally.

#### 4. CONCLUSION

Based on the results of data analysis, the development of Android-based digital teaching materials shows very good qualifications from experts, practitioners/teachers, and students. Therefore, it can be concluded that *android-based digital* teaching materials on the topic of changing the form of objects for class V elementary school are categorized as suitable for use in the learning process on the topic of changing the shape of objects for class V elementary school.

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