

# Development of Learning Media Based on Technological Pedagogical Content Knowledge Concepts for the Eight Grade Junior High School

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## ABSTRACT

This study discusses the development of learning media based on technological, Pedagogical, Content Knowledge (TPACK) for the students in the Eighth Grade of Junior High School. A learning media developed based on an Android-based learning application designed using Spring Suite 9 and Padlet with teaching materials to improve a flat side geometry. Create the learning application research using the ADDIE model. The data used is the validation results of media and material experts obtained through a validation questionnaire and the practicality test results through the practicality test. Based on the results of the data analysis, the learning application is valid and practical; therefore, it is feasible to use for learning activities.

**Keywords:** Geometry, Learning Media, TPACK.

## 1. INTRODUCTION

The development of information technology rapidly allows for more data and information broadly and practically. The technology connects the world and geographical barriers so that the world becomes borderless. The outlines of science and technology were explained in the Qur'an, Long before technology developed. As humans, only to explore and develop existing concepts and theories as to the word of God in QS ar-Rahman/55:33

يَمْشُرُ الْجِنَّ وَالْإِنْسَ إِنِ اسْتَطَعْتُمْ أَنْ تَنْفُذُوا مِنْ أَقْطَارِ السَّمَوَاتِ  
وَالْأَرْضِ فَانْفُذُوا لَا تَنْفُذُونَ إِلَّا بِسُلْطَانٍ ۝٣٣

*Hi, jinn and humans! If you can penetrate (cross) the corners of the heavens and the earth, then penetrate. You will not be able to penetrate it except with power (from Allah) [1].*

The verse gives a scientific signal to the jinn and humans, and Allah has created them to explore outer space with their ability and strength. The cleric said the strength referred to the science and technology [2]

Science and technology is a very important requirement. For teachers, knowledge of technology is a competency that must be mastered to support improvements in the learning process. In addition to the material (content), the teacher must also have the ability to design learning (pedagogic) which is then collaborated with the ability to use technology (technological) [3].

One of the frameworks that integrate the technology in a learning process is TPACK. TPACK is a framework of thinking formulated from 3 types of basic knowledge. They are Technological Knowledge/TK (science technology), Pedagogical Knowledge/PK (material teaching approach), and Content Knowledge/CK (a material mastered by the teachers) [4]. Thus, the application of TPACK in the learning process makes teachers not only use models or appropriate approaches to teach a material, but also apply technology and a certain approach in learning activities.

In this study, Technological knowledge (TK) meant an application using an android system. Choose the use of an android operating system because the device size is smaller than a desktop PC so that we can use it anywhere and anytime. The worldwide operating system market share in 2020 puts the android operating system in the first level, 38.3%. It shows that the level of ownership and use of Android is relatively high compared to IOS made by Apple and Windows Phone [5]. In addition, the use of the Android operating system increases the ability of mathematical problem solving [6].

The PK in this study referred to the Realistic Mathematics Education (RME) approach. Choose the RME approach as one of the learning mathematics approaches oriented to students' daily life experiences. Thus, students can use this real-world experience as a starting point to develop mathematical ideas and concepts in a learning process [7]. Mathematics learning using the

RME approach will improve students' mathematical communication skills and increase students' interest in education [8]. The CK in this study is a flat side geometry. A flat side geometry shape is a shape that consists of content or volume and has a flat side. The material teaching of a geometry flat side will be easier to understand if teachers use direct depiction. It would be better if the pictures of the spatial structure were packaged in learning media; therefore, they are more effective and efficient [9].

According to Wijaya, applying learning media with the TPACK concept can encourage students to be more active in asking and answering. In addition, students also feel happy because they involve a new way of learning. They use technology to explain the basic concepts of a material. Teachers are also freer to use learning media combined with learning approaches [10]. The use of structured TPACK is more effective in delivering lessons with technology integration[11]. One of the factors that can overcome the stress level of teachers on the use of technology in learning activities [12].

Z. A Farizi et al, have used TPACK to develop learning media in the form of animated videos[13]. But this study uses the TPACK concept to develop learning media in an Android-based application. The application is in the form of allowing students and teachers to interact directly. In addition, students are freer to choose, synthesize and elaborate on the knowledge they want to understand. This learning media is also facilitated with interactive quizzes.

The results of an interview with one of the mathematics teachers at SMP Negeri 1 Sabbang stated that the material in constructing geometry of flat-sided in class VIII of SMP Negeri 1 Sabbang was presented using learning videos after the regulations regarding the implementation of online learning (in the network). Even though the learning media used are technology-based, the presentation of geometry of flat-sided material using learning videos. It only involves the senses of sight and hearing. The ability of students to remember the material

more minor than the presentation of fabric can make students interact with the learning media.

According to Zainuddin, a person can only remember 20% when they see, 30% when they hear, and 50% when listening and see, but someone can retain 80% when they see, hear and practice it [14]. Based on this, learning media is needed whose use involves the senses of sight, hearing and encourages students to be active in the learning process. One learning media that can use with the TPACK concept will connect to technology, pedagogy, and content or material.

**2. RESEARCH METHODS**

The Research and Development (R&D) uses the ADDIE model (Analyze, Design, Development, Implementation, and Evaluation). The instrument research used a validation questionnaire and practicality questionnaire. The validation questionnaires were given to the validators of media and material experts. As for the practicality questionnaire, 29 students of the eighth grade of SMP Negeri 1 Sabbang conducted trials of the learning media products development.

The data obtained from the research results are classified into two, namely qualitative data and quantitative data and collected Qualitative data in the form of criticisms and suggestions put forward by material experts and media expert validators to improve the development of learning media products. In contrast, quantitative data is obtained from a validation questionnaire using a 5 Likert scale (very poor, lacking, sufficient, good, excellent).

Based on the validation questionnaire and the practicality that has been filled out by each validator and some of these students, can find the percentage using the formula

$$\text{Percentage} = \frac{\sum \text{Scor per item}}{\text{maximum score}} \times 100\%$$

Based on the percentage results then categorized according to the following table.

**TABLE 1.** Product Validity/Practicality Assessment Category

%	Category
81-100	Very Valid/Very Practical
61-80	Valid/ Practical
41-60	Sufficiently Valid/Sufficiently Practical
21-40	Less Valid / Less Practical
0-20	Invalid/ Impractical

### 3. RESULTS AND DISCUSSION

obtained learning media based on the TPACK concept of geometry flat-sided materials through needs analysis, curriculum analysis, selection of media builder software, collection of references, making flowcharts, making storyboards, and improving some inputs and suggestions from media validators and material experts. The preparation of learning media is adjusted to the TPACK concept. So that the final result of the developed teaching media fulfills three main things, namely technology (the outcome of teaching media application with the android operating system), pedagogy (presenting material according to the stages of the RME learning approach), any content or material (Geometry). The learning media developed contains several parts, including:

#### 3.1. Introduction

Design the introduction of using Microsoft PowerPoint 2019 software. This display contains the name of the learning media, namely KUBALIS. The word KUBALIS is an acronym for several flat-sided shapes, as shown in text and images.



Direct translation:  
Cube, Cuboid, Prism, Pyramid

Figure 1. The display in KUBALIS Learning Media

#### 3.2. Opening

This section contains an open animated video, an invitation to pray before studying, and students are invited to learn at the end of the video.



Direct translation:

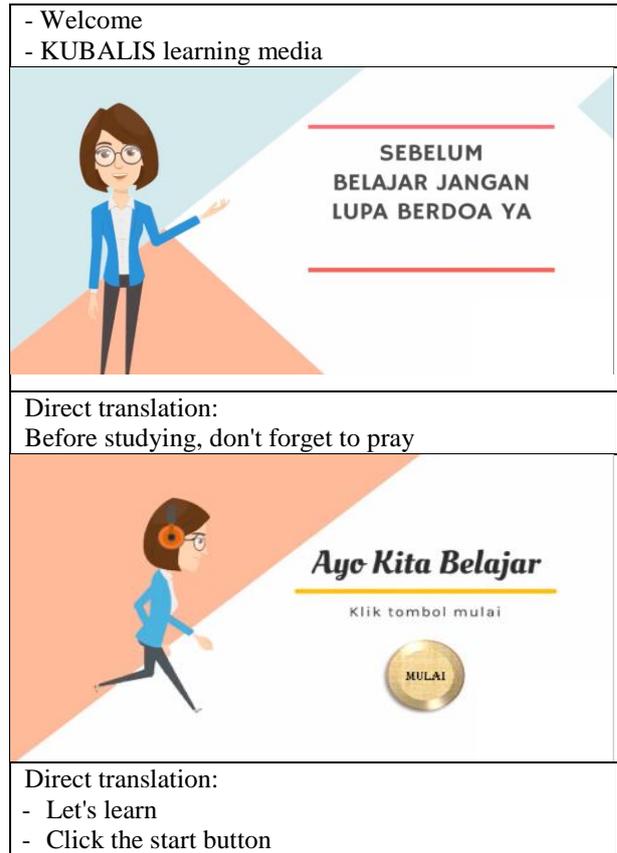


Figure 2. The opening display consists of welcome greetings, Invitations to prayer, Invitations to study.

#### 3.3. Menu

The main menu is designed using *PowerPoint 2019*. The main menu section consists of 6 menus, namely instructions for use, competencies, materials, quizzes and evaluations, profiles, and references.



Direct translation:  
- The main menu  
- Instructions for use

Figure 3. Menu of KUBALIS

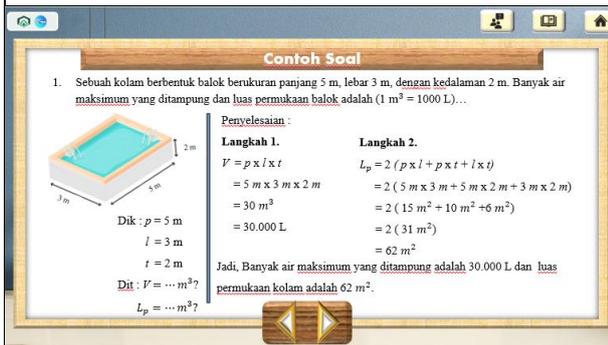
#### 3.4. Material

The presentation of the material is adjusted to the RME learning approach where the contextual problems are presented, the explanations about contextual issues

only reach the stage where students know the contextual issues contributed. Then provide opportunities for students to solve problems by understanding the definitions, elements, how to calculate the surface area and volume of a cube, then the discussion stage and concluding the previous contextual issues. Discussion and conclusion activities are carried out in the discussion room on this learning media.



Direct translation:  
 "The tea drinks are packaged in a block-shaped box as shown in the following figure. That box is 5 cm long and 4 cm wide. If the box contains 200 ml find the height and surface area of the box? ( $1 \text{ ml} = 1 \text{ cm}^3$ )"



Direct translation:  
 - A rectangular pool is 5 m long, 3 m wide and 2 m deep. The maximum amount of water it can hold and the surface area of the block is ( $1 \text{ m}^3 = 1000 \text{ L}$ )...



Direct translation:  
 - The following is a link to discuss, please click according to your class.  
 - Before clicking on the link, don't forget to read the discussion instructions in the main menu

- Make sure you are connected to the internet so you can have discussions/presentations with your classmates.

Figure 4. The material consisting of contextual issues, the exercise, and the discussion room

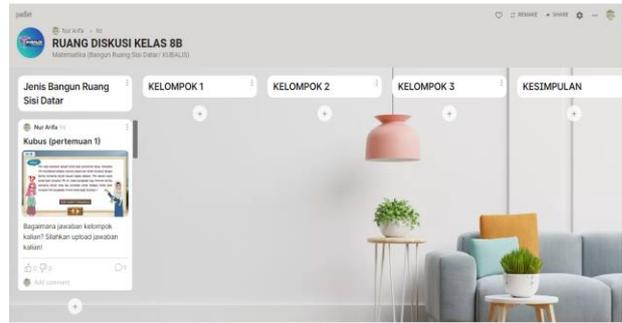


Figure 5. The discussion room on KUBALIS

### 3.5. Quiz and Evaluation

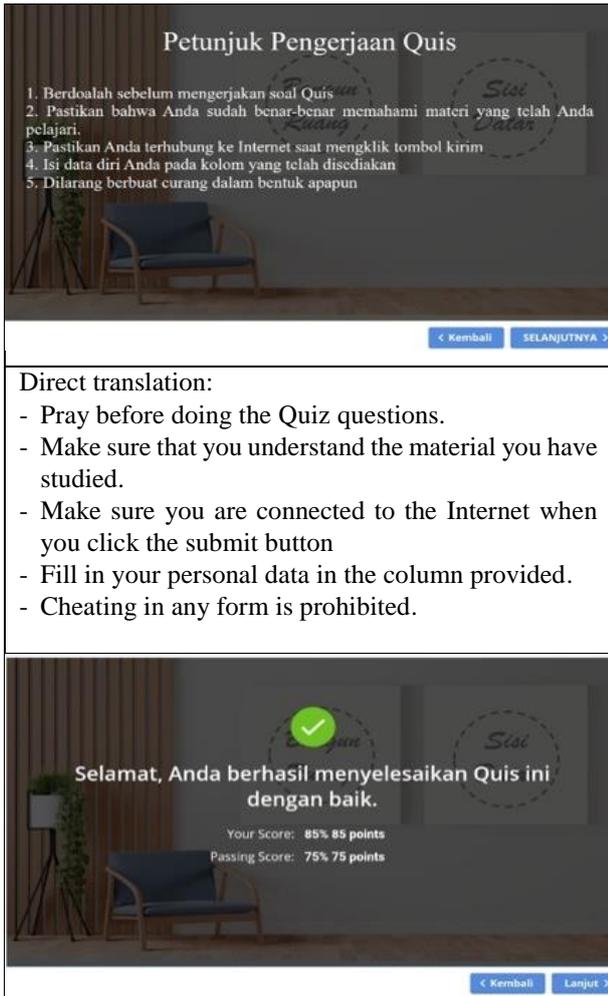
Made the quiz and evaluation section is using the iSpring Suite 9 software. There is a quiz menu section in the quiz and evaluation section consisting of five examinations and one evaluation. There is an initial opening display in the quiz section, student data columns, quiz work instructions, several multiple-choice questions, and hotspots.



Direct translation:  
 - Welcome to the KUBALIS, Learning Media Block Quiz.  
 - Click the "start" button to take the Quiz.



Direct translation:  
 "Come on Enter your data"



Direct translation:

- Pray before doing the Quiz questions.
- Make sure that you understand the material you have studied.
- Make sure you are connected to the Internet when you click the submit button
- Fill in your personal data in the column provided.
- Cheating in any form is prohibited.



Direct translation:

“Sorry you haven't successfully completed this Quiz, keep it up”.

**Figure 6.** Quis and Evaluation Menu

The learning media, of course, requires validation from media expert validators and material experts. For this reason, researchers conduct an assessment of the level of validity addressed to media experts. From the validation that has been done, eating produces the following validation of development products:

**Table 2.** Score by Expert Validator

No	Validator	Rated aspect	Earnings score	Maximum Score	Percentage	Interpret
1.	Media	Appearance	39	50	80	88.43
		Programming	21	25		
		Learning	10	10		
2.	Material	Contents	80	80	96.87	(very valid)
		Language	20	20		
		Quiz	30	30		
		Utility	20	20		

Based on the results of a validation of the media expert's assessment, it obtained a score of 80% with the material expert's review and 96.87% with a very valid category. The validator sees that the product developed has been good from all indicators, so that it concludes that it is feasible to use with minor revisions.

In the implementation phase, an online product trial activity was carried out through the Whatsapp application with 29 class VIII SMP Negeri 1 Sabbang students to determine the level of practicality of the learning media developed. The following are the results of the practicality test scores.

**Table 3.** Practicality Test Score Results

Validator	Rated aspect	Earnings score	Maximum Score	Percentage	Interpret
Student	Media Presentation	759	870	88	88 (very Practical)
	Ease of Understanding	253	290		
	Interest to learn	256	290		

The trial results to assess the practicality of the developed product obtained an average score of 88% in the efficient category. Overall, students gave an upbeat assessment.

#### 4. CONCLUSION

The learning media based on the concept of Technological Pedagogical Content Knowledge meets the eligibility standards used as seen from the results of a validator assessment average results obtained a value of 88.43% with a very valid, and the consequences of trials on 29 grade VIII students of SMP Negeri 1 Sabbang showed the results by 88% with a very practical.

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