Development of Comic Mathematics Learning Media Based on Contextual Approaches

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Abstract: The development of teaching materials or instructional media that are tailored to the characteristics of students is considered important at this time. For this reason, this study aims to develop comic-shaped mathematics learning media based on a valid and practical contextual approach. This comic was developed based on the stages of the ADDIE development model. Based on the analysis of the data, it was concluded that this comic based contextual approach was valid and was practically used. This contextual approach-based comic can be used as an alternative learning media for material on flat side spaces.

Keywords : Polyhedron; Comic; Contextual; Learning media

Introduction

Comics are one of the most preferred picture media. It is proven by the inclusion of comics as the top 10 bestsellers in Gramedia bookstores. In 2008, 52% of children and teenage book sales were comics (Setiawan, 2013). The same thing was also reported by Tribunnews.com correspondent Ricard Susilo from Tokyo, Japan, who said that currently, Indonesia ranks readers manga second-most in the world of (comics from Japan) after Finland. In Indonesia, three comics per day (Widiyabuana, 2013). The results of this survey show that Indonesian people like comics.

Munadi (2010) states that comics usually contain cartoons, presented in a simple, concise, easily understood because it is equipped with dialogue between characters. If the subject matter is designed in such a way as a comic, then in addition to being a medium of entertainment, comics can also be used as learning media. Le Doux (Hima, Ni'mah, & Kurniati, 2016) revealed that comics are the right media for learning because the emotional involvement of readers will significantly affect the memory and recall of the subject matter that is obtained. According to (Fatimatus, Utariyanti, Wahyuni, & Zaenab, 2015), comics are learning media that can attract student attention. Simple drawings and dialogue between characters make it easy for students to understand the contents of the story so that comics can be used as informative and educative media for students especially if the contents of the stories presented in the comics contain stories that present facts, events and realities that occur in real life, that is, if the subject matter is designed

in the form of comics and is contextual in nature, then the comic can be an interesting, real and meaningful learning medium for students as revealed by (Widayanti, Dwidayati, & Hendikawati, 2016) that comics that present mathematical problems in everyday life are effectively used to improve students mathematical understanding and disposition. The results of the study show that comics that contain material delivered with a contextual approach can be an effective medium for learning mathematics.

A contextual approach is a learning concept that links material to real-world situations, and students are encouraged to connect their knowledge with applications in everyday life. Thus, learning becomes more productive because students are required to actively find their own understanding based on the experiences they have experienced (Putra, 2013). According to (Yuniati, 2018) added that the contextual approach does not require students to memorize, but rather encourage students to construct knowledge that already exists in themselves. The results of Imammuddin's research (Imamuddin, Isnaniah, Putra, & Rahmadila, 2019), concluded that the contextual approach could be an alternative approach to learning mathematics. The constructivist component of the contextual approach encourages students to build understanding based on their experiences. So, it can be concluded that the contextual approach is a learning concept that links material to real life, thus making learning more practical, meaningful, and encouraging students to build understanding based on their experiences. According to (Wulandari & Rahayu, 2017), learning with a contextual approach is closely related to teaching materials or teaching media that must be prepared by the teacher.

The use of instructional media with the right approach can certainly help to learn to be interesting and useful in increasing student understanding. Nurdin, Risnawati, & Ayurila (2019) suggested that the use of appropriate learning media in learning can improve students' knowledge, motivation, and interest in education. According to (Nuryadi, 2019; Suhartini & Santoso, 2014) that teachers need to develop learning tools that are interesting and can encourage students to be active in learning activities. One of the learning media that is considered to be able to attract students' interests in comics. Various studies have been conducted to develop learning media in the form of comics. Among them, (Hidayanti, 2015) research which developed-based mathematical comics edutainment. The comics he designed for circle material were able to facilitate the achievement of students' understanding of concepts and motivation. Pardimin & Widodo (2017) have developed a based comic learning media problem-solving. The Comic has been declared feasible and can be used for learning geometry.

In contrast to this research, in this study, researchers designed a learning media in the form of comics based on a contextual approach. This contextual based comic is a newly developed media for building material in flat side space, Comic developed for presenting content in building flat side space that is associated with real life. The purpose of this study was to create a valid and practical comic-shaped mathematics learning media for building material on a flat side.

Method

The purpose of this research is to develop a product in the form of learning media. Thus, this research is research and development. Mulyatiningsih (2014) states that the development model commonly used to design teaching materials is the 4D and ADDIE, development models. The choice of the development model is because the steps for developing it are more accessible and more straightforward. As the name implies, this development phase consists of the stages of analysis, design, development, implementation, and evaluation (Pribadi, 2009).

The subjects in this study were students of class VIII.4 SMP Negeri 20 Pekanbaru. The object of research is a contextual learning media in the form of comic-based mathematics for building material in a flat side space. Data collection was carried out using a Likert scale questionnaire with five options. There are two types of questionnaires, namely the validity questionnaire and student response. The validity questionnaire is a questionnaire intended to see the validity of the media developed. The validity questionnaire was filled by expert validators, namely two mathematics education lecturers to assess material and technology aspects. While the student response questionnaire was filled in by students, used to see the level of contextual based comic practicality.

Based on the research objectives, two comics tests will be conducted, namely the validity test and the practicality test. Validity test is carried out by educational technology experts and mathematics learning material experts to see the quality of the product through the validity questionnaire. Validity includes the appropriateness of design and learning media material in the form of comics based on contextual approaches with the objectives of learning, conformity, and continuity between elements in learning media in the form of comics based on contextual approaches. The second is practicality test, carried out to identify the level of usage of a learning media in the form of comics based on contextual approaches that are practically used, easy to understand, and enjoy using products, both teachers and students. This practicality test is done by implementing the product to students. Data obtained from questionnaires were then analyzed using descriptive analysis techniques with a qualitative approach. This qualitative descriptive analysis technique is used to process data from the results of educational technology experts and mathematics learning material experts in the form of criticism, suggestions, and comments about the improvement of learning media in the way of comics. Then, the percentage of each item in the questionnaire of validity and student response is calculated. Contextual-based comics can be said to be valid and practical if the percentage obtained is more than 61% (Febliza & Afdal, 2015).

Result and Discussion

As it has been revealed that contextually based comics are developed based on the stages of ADDIE research and development, namely:

Analysis Phase

At the analysis stage, the researcher analyzes the student's needs and analyzes the curriculum used. The learning media is intended for students of class VIII junior high school-aged between 12 to 14 years. According to Piaget (Ibda, 2015), at this age, students are in the transition zone from the concrete to the formal operational stage. This means that students of this age can already use concrete operations to shape their concrete operations. The student begins to be able to think abstractly but still needs help in the form of concrete objects and events. Therefore, contextually based comics are considered suitable to be used as learning media for these students.

Furthermore, curriculum analysis is carried out. Curriculum analysis conducted includes analysis of content structure and concepts. The content structure is in the form of core competencies, basic competencies, indicators, and learning objectives based on the 2013 curriculum (K-13). The material contained in the comics is material to build flat side spaces. The concepts discussed are (a) elements and networks of cubes, beams, prisms and pyramid (b) surface area of cubes, beams, prisms, and pyramid, (c) volumes of cubes, beams, prisms and

pyramid and (d) the area of surface and volume of the irregular flat side chamber and its application.

Design Phase

Carried out with the help of the application Medibang Paint. This application is a digital painting program and making comics that are lightweight and free, and can be used via Android. Contextual-based comic design stages are in accordance with the stages of making comics by (Saputro, Haryadi, & Yanuarsari, 2016), namely (a) making plots, (b) defining characters, (c) making drafts in pencil, forming outlines drawing and erasing drafts pencil, (d) drawing, adding black ink and giving color to comics, (e) adding dialogue, (f) adding comic components and making corrections, (g) printing comics and (h) marketing / distributing comics. This final stage is not carried out because the licensing has not been taken care of and does not yet have an ISBN.

The following is a brief contextual comic-based display design with a number of components that have been improved according to the suggestions and comments of validators: Contextual-based learning media in the form of the main title, namely: "MATHEMATICS COMICS BASED ON CONTEXTUAL APPROACH TO FLAT SIDE SPACE." A mathematical comic contextual approach to build flat side, which builds flat side space as material presented in the comic. The design cover comic after revision can be seen in the following image:

Figure 1 Cover Design

KI, KD, Indicators and Learning Objectives

Core competencies (KI), basic competencies (KD), indicators and learning objectives are based on the 2013 curriculum. Views for KI, KD, indicators and learning objectives are as follows:
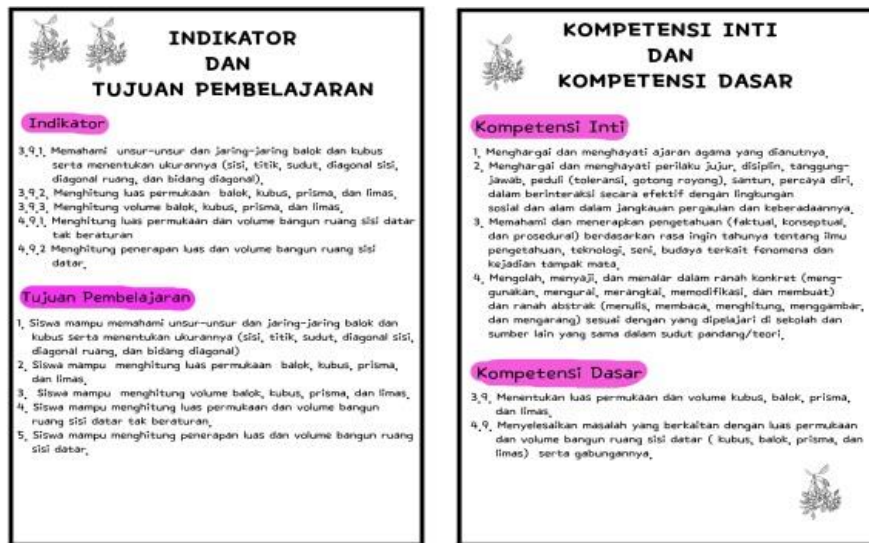
Figure 2. TheKI, KD, Indicators and Learning Objectives Design

Instructions Usage

Instructions contain about how the flow of reading conversations on learning media in the form of comics based on contextual approaches. Following are instructions for using this comic:
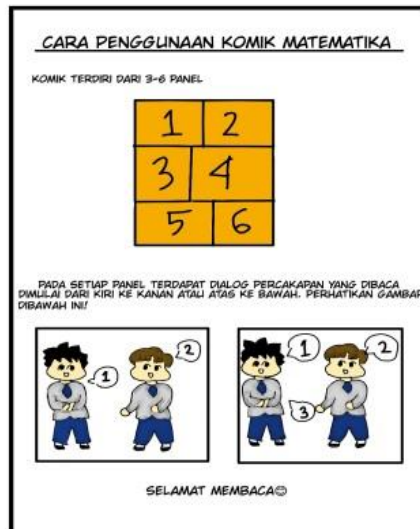

Figure 3. Design Instructions for Using

Character Introduction and Prologue

Character recognition is designed to make it easier for readers to recognize the characteristics of the characters presented in the comics. A prologue is an opening story that contains a storyline, arranged so that readers are interested in reading this comic to its conclusion. Display recognition of figures and prologues can be seen in the following picture:

Figure 4. Design of Character Introduction and Prologue

Contents of the Story (Description of Learning Materials)

Material to build flat side spaces in this comic is presented in the form of conversations between comic characters with different story lines in each section. The number of meetings on the material to build this flat side space as many as four meetings, so that this comic is divided into four parts as well. Each meeting uses a different comic section tailored to the subject matter that will be delivered at the meeting. The following is an example of how each part of the story displays:
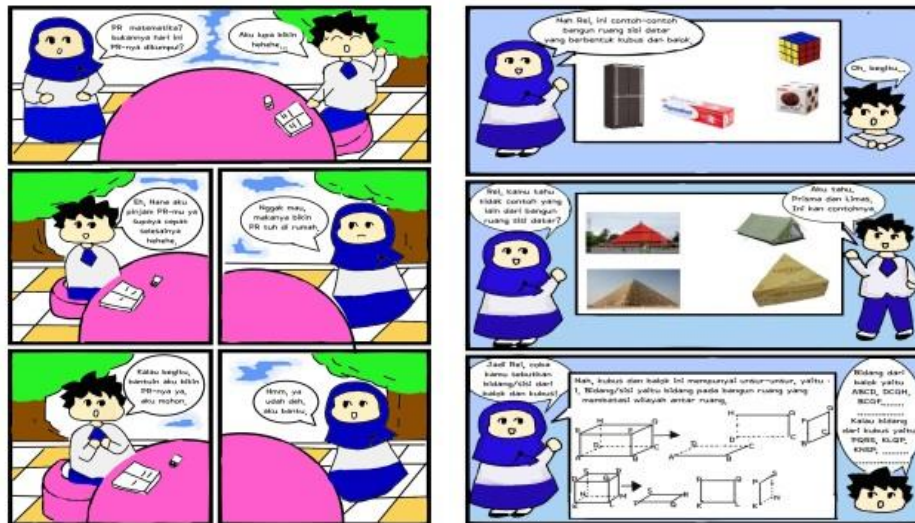

Figure 5. Story Part 1: Elements and Nets of Cubes, Beams, Prisms and Limas
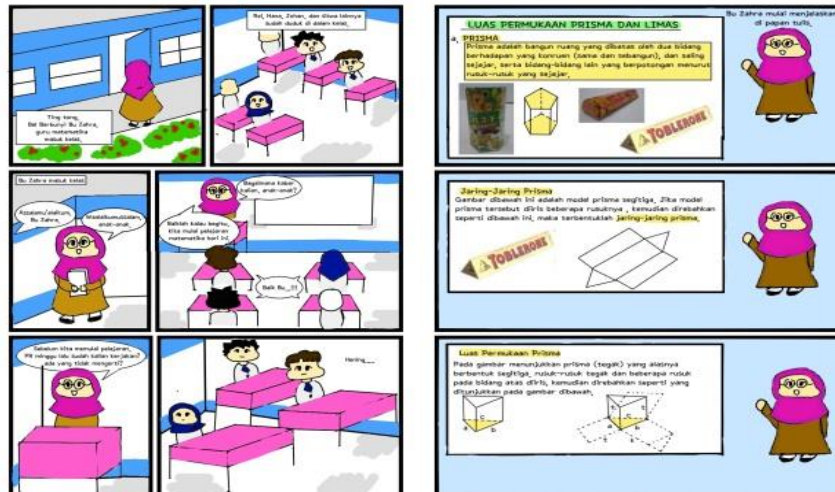
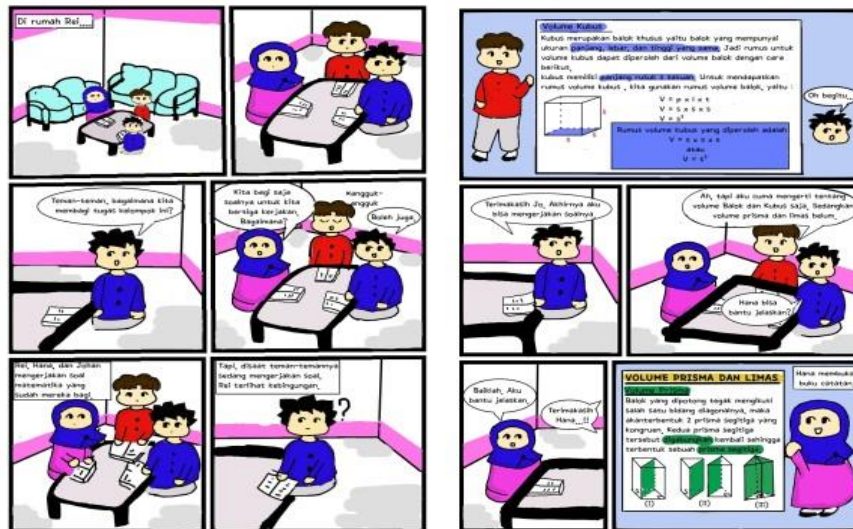**Figure 6.** *Story Part 2: Surface Area of Cubes, Beams, Prisms and Limas*

Figure 7. *Story Part 3: Cubes Volume, Beams, Prisms and Limas*

Figure 8. Story Part 4: Application of Surface Areas and Volume of Cubes, Beams, Prisms and Limas
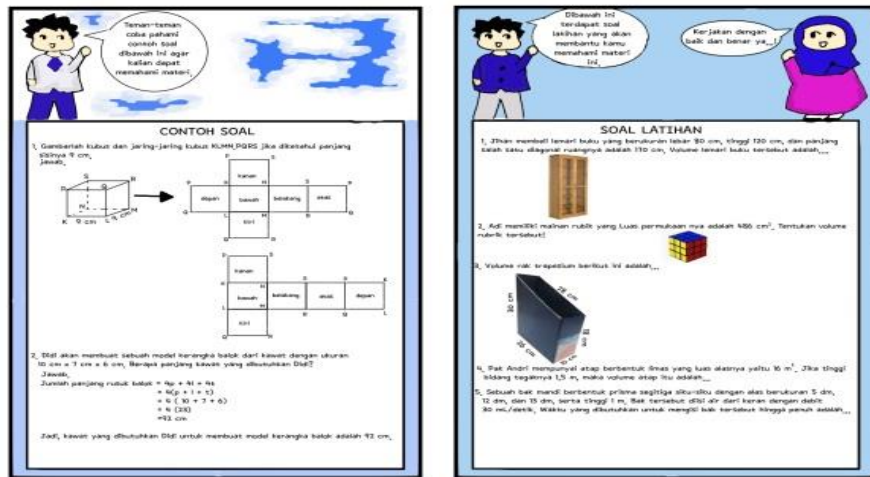
Figure 9. Sample Design and Practice

Development Phase

After the contextual comics are designed, the next step is to test the validity of the comics. To see the feasibility of the comic, a questionnaire was used which was filled in by expert validators, namely mathematics education lecturers who were considered experts in the field of educational technology and material experts in the field of geometry. The results of the contextual comic-based validity test can be seen in the following Table 1 and Table 2:

Table 1. Expert Test Validation Results Learning Material

No	Indicator Rating	Validity Value
1	Didactic aspects	84,70%
2	Construction requirements	81,11%
3	Display quality	82,50%
	Average	82,77%

Table 2. Educational Technology Expert Validation Results

No	Indicator Rating	Validity Value
1	Comic Anatomy	92,50%
2	Image quality	90,00%
3	Technical requirements	88,33%
	Average	90,27%

In Tables 1 and 2 it appears that the average the average percentage obtained from expert learning materials is 82.77% and 90.27% for educational technology. Overall, the contextual test of comics based on contextual is 86.52%. This percentage has exceeded the product validity criteria, which is 61% (Febliza & Afdal, 2015). This means that contextual based comics are appropriate to be used in terms of learning materials and educational technology. However, comments and suggestions from subject matter experts and educational technology are used as improvement material to perfect the preparation of this comic.

Implementation Phase

After the comic developed is declared valid, then this comic has been appropriate to be used for learning material to build flat side spaces. Learning using contextual based comics is given to students of class VIII.4, SMP Negeri 20 Pekanbaru, amounting to 26 people. After students get the material on the flat side space presented in the form of this comic, students are given a questionnaire to see students' responses to the practicality of using this contextual based comic. The results of contextual based comic practicality test can be seen in the following table:

Table 3. LKS Practicality Test

No	Indicator Assessment	Practical Value
1	Student interest and comic display	93,80%
2	Process of using	94,03%
3	Context contained in comic	93,76%
	Average	93,86%

Based on the table above, the average percentage of student responses was 93.86%. This value has exceeded the practicality criteria, which is 61% (Febliza & Afdal, 2015). So, contextual based comics are considered practical to be used to build flat side space.

Evaluation Phase

The evaluation process in this study was not only conducted at the end of the study but from the beginning of the study, namely the analysis phase. Evaluation is done by paying attention to the suggestions and input from expert validators and students. Advice and information from validators and students are used as revision material. The revisions made based on expert validator suggestions include fixing dialogue balloons that stick to writing, fixing problems that do not contain context, replacing images and colors that are less attractive, beautifying sketches of images, and adding backgrounds more interesting and completing sentences with punctuation marks that are corresponding.

Based on the results of research and data analysis, contextually based comics are considered feasible and practical to use. Comics based on contextual approaches can be used as alternative learning media that can facilitate students' mathematical abilities. This contextual-based comic describes the material of building a flat side space that is associated with real-life and self-experience of students so that it can attract students' interest and motivation to learn, actively build their own knowledge. In contextual learning, students are directly involved in finding concepts, ideas based on their daily experiences (Indah Nartani, Aliim Hidayat, & Sumiyati, 2015). Andari's research results (Andari, 2012) concluded that learning with a contextual approach can improve mathematics learning achievement. Agustyarini & Jailani (2015) said that by linking subject matter with real life, students understood that the lesson was beneficial for their lives. This can arouse students' curiosity, so they actively learn and ultimately can improve their learning achievement. In contextual learning, students are guided to construct knowledge based on their experiences, as (Anagün, 2018) said that the constructivist approach to learning has a positive effect on 21st-century skills. The essence of constructivism-based learning is how teachers become creative and responsible for preparing learning that guides students to think and respond to students' thinking (Simon, 1995).

In addition to the use of approaches in learning, learning media are also important. According to (Sutiarso, Coesamin, & Nurhanurawati, 2018), the use of instructional media, such as visual aids, charts, and visual media, is quite effective in increasing students' mathematical understanding. Comics can be an effective media or learning resource. The results of the study (Herbst, Chazan, Chen, Chieu, & Weiss, 2011) show that comics can be a source of learning that shows how technology can support learning.

Contextual-based comics developed in this study are learning media in the form of visual media that contain cartoon storylines, contain pictorial characters that clarify the words of the stories in the comics, and use attractive colors. St. Clair (2018) states that integrating cartoons with mathematics can show the humanity of mathematics, improve communication, and the joy of learning mathematics. Cartoons explain concepts and connect mathematics with real-life better. Stories in comics are closely related to events experienced by students in their daily lives so that they can more easily understand the problems they face (Danaswari, R, Kartimi, Roviati, 2013). Comics use complex interactions between writing and images that provide the potential to convey concepts and motivate effective student involvement (Hosler & Boomer, 2011). As also said by (Cervesato, 2011) that learning using comics improves student performance, students

become active learning agents and create open discussions among students. Students can also make their own math comics. By creating their own comics, students can share their mathematical understanding, enhance creativity, and construct their own knowledge (Francis Pelton & Pelton, 2009).

Conclusion

Development of teaching materials or learning media that encourage students to actively instruct their own experiences need to be developed as an effort to improve student mathematics learning outcomes. Research and development with ADDIE stages aim to produce valid and practical learning media. Based on the results of research and data analysis, it can be concluded that comics based on contextual approaches have been valid and are practically used. This contextual approach-based comic can be used as one of the learning media for material to build flat side spaces. This research can be continued to examine the effectiveness of using contextual media-based comics.

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