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Smart Apps Creator (SAC) Assisted Comic Media Development in Optimizing Visual Spatial Intelligence

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ABSTRACT

This study aims to produce SAC-assisted comic media and analyze the effectiveness and quality of using comics media to optimize students' visual-spatial intelligence. This research is a Research and Development (R&D) research using a 4D development model, which includes four stages: define, design, develop, and disseminate. In the "define" stage, the researcher did observations and interviews and distributed questionnaires to teachers and students. In the "design" stage, the researcher made prototypes of media development and visual-spatial intelligence test questions. At the "develop" stage, small group trials were conducted with three mathematics teachers and five students in class XI. Furthermore, a product revision was carried out, which was then the product of the revised result, which was tested again in a large group, namely the class XI students of SMK Islam Madani consisting of 25 people. Finally, in the "disseminate" stage, socialization was carried out with mathematics teachers at the school where the researcher took the subject. The population in this study are mathematics teachers and students of class XI SMK Islam Madani, Kab. Tasikmalaya, West Java, with three mathematics teachers and 25 students of class XI majoring in Multimedia as the subjects. The research instruments used in this study were Teacher and Student Response Questionnaires and Visual Spatial Intelligence Test Questions. The results showed that the comic learning media is in the category suitable for use by students, with the calculation of the teachers' and student's response questionnaires having very good interpretations. Furthermore, the quality of the effectiveness of the visual-spatial intelligence of students after using comics learning media on geometry material gets a value of 1.58 with the "strong effects" criteria so that the SAC-assisted comic learning media is effectively used in learning.

Keywords: *Comic media, visual-spatial intelligence*

ABSTRAK

Penelitian ini bertujuan untuk menghasilkan media komik berbantuan SAC dan menganalisis efektivitas serta kualitas penggunaan media komik dalam mengoptimalkan kecerdasan visual spasial peserta didik. Penelitian ini merupakan penelitian *Research and Development* (R&D) dengan menggunakan model pengembangan 4D meliputi 4 tahap, yaitu: *define* (pendefinisian), *design* (perancangan), *develop* (pengembangan), dan *disseminate* (penyebarluasan). Pada tahap *define* (Pendefinisian) dilakukan observasi, wawancara dan penyebaran angket kepada guru dan peserta didik. Pada tahap *design* (perancangan) dibuat *prototype* pengembangan media dan soal tes kecerdasan visual spasial. Pada tahap *develop* (pengembangan) dilakukan uji coba kelompok kecil kepada 3 orang guru matematika dan 5 orang peserta didik kelas XI. Selanjutnya dilakukan revisi produk yang kemudian produk hasil revisi tersebut yang diuji cobakan kembali pada kelompok besar yaitu peserta didik kelas XI SMK Islam Madani yang berjumlah 25 orang. Pada tahap *disseminate* (penyebarluasan) dilakukan sosialisasi kepada guru matematika di sekolah tempat pengambilan subjek. Adapun populasi dalam penelitian ini adalah guru matematika dan peserta didik kelas XI SMK Islam Madani, Kab. Tasikmalaya, Jawa Barat, dengan subjek sebanyak 3 orang guru matematika dan 25 orang peserta didik kelas XI jurusan Multimedia. Instrumen penelitian yang digunakan dalam penelitian ini adalah Angket Respon Guru dan Peserta Didik dan Soal Tes Kecerdasan Visual Spasial. Hasil penelitian menunjukkan bahwa media pembelajaran komik berada pada kategori layak digunakan oleh peserta didik, dengan perhitungan hasil angket respon guru dan peserta didik berinterpretasi sangat baik. Kualitas efektivitas kecerdasan visual spasial peserta didik setelah menggunakan media pembelajaran komik pada materi geometri bangun ruang, mendapatkan nilai 1,58 dengan kriteria "*strong effects*" sehingga media pembelajaran komik berbantuan SAC efektif digunakan dalam pembelajaran.

Kata kunci: *Media Komik, Kecerdasan Visual Spasial*

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Introduction

The educational process cannot be separated from the learning process. The teacher's learning process provides knowledge as a provision for students to solve life problems (Masykur et al., 2017). Therefore, the learning process will run optimally if the supporting media is available. Media is a tool for educators to convey messages or information to students in the learning process. The media is a means to transform or convey messages (Syafiqah et al., 2020). The use of learning media is one component in the learning process in schools to facilitate students' understanding of a concept or learning material. For example, the difficulty of learning a mathematical concept can impact the difficulty of students in learning other concepts (Supratman, 2018). So that the use of learning media will run well if teachers, students, and schools work together to build mutual awareness about the importance of media to create learning that makes it easier for students to understand concepts and materials and create exciting learning.

One of the exciting media for students is comics. Comics are one of the learning media that serves to convey instructional messages. Comics' combination of images and storylines can be a unique attraction for students to read. (Pranata, 2005) suggests that a person will optimally learn if he communicates or interacts with a stimulus that matches his learning style. In addition, (Purwaningrum, 2016) argues that comics media are applied in mathematics learning because they can be used as tools, knowledge, and mentors for mindsets and attitudes. Mathematics is only driven by counts and numbers, so the learning atmosphere becomes boring and unattractive without a stimulus, so it is necessary to have interesting and fun media in the learning process, such as comic media. Therefore, comics function well as visual communication learning media, where this learning context will refer to the communication process between students and learning resources.

The results of a research regarding the use of e-comic-based learning media for students at the high school level are effective, efficient, innovative, and fun (Aeni & Yusupa, 2018). An e-comic model is run on a mobile device in which a cartoon-shaped graphic is highlighted to convey learning materials per the applicable curriculum. Learning material is delivered in the form of stories so that the delivery is not rigid. Implementation of the prototype trial in the field obtained data that students liked this e-Comic learning media model and felt learning was like reading comics in digital format so that this learning media could increase students' attention in understanding learning.

Comic learning media is made to help the learning process but only relates to the sense of sight. So we need the help of other learning media to package the comic media to make the learning process effective and optimal so that it can provide understanding to students. The problem that occurs in the field is that many educators have not been able to optimize existing technology to realize learning that involves technology-based learning media such as computers and smartphones (Wibawanto, 2017). Therefore, the use of android in smartphones and computers is expected to create exciting learning media so that the process of achieving learning objectives will run smoothly. One of the platforms that can be used to create mobile learning media based on Android is Smart Apps Creator (Rachman, 2019).

Smart Apps Creator is software to create various multimedia applications based on mobile, desktop, and web. The final result of its development can be converted into several application bases, namely Android, IoS, Desktop, and HTML5 Web which can be accessed through a browser. Android-based learning media created using Smart Apps Creator can be used offline so that students do not need internet access to use this media. In addition, this learning media

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can be disseminated manually through data transfer. Therefore, android-based learning media needs to be developed because it is more effective and efficient in helping teachers in the learning process so students can more easily understand the material they are learning (Mufarichah, 2021).

Based on the results of observations and interviews with mathematics teachers at SMK Islam Madani, stated that the curriculum used in the school was an integrated curriculum that combined productive learning (multimedia) with general learning. Therefore, learning in class was not entirely based on the national curriculum but adapted to the national curriculum. The characteristics of students majoring in multimedia are: able to observe, form, and use images as a remembering process, enjoy learning with graphics or visual form tools, are interested in careers such as architects, designers, and also careers that use visual abilities. In the multimedia department, it is closely related to images and visualization.

So far, it has not been found in the development of comic media assisted by Smart Apps Creator, which contains a menu of learning materials in the form of digital comics, sample questions, games, practice questions, and online or virtual classes that connect to a zoom link or other online learning applications. Based on this, the use of comics as a learning tool combined with Smart Apps Creator is expected to optimize students' mathematical intelligence, especially visual-spatial intelligence.

Visual-spatial intelligence is intelligence that includes the ability to think in pictures, as well as the ability to absorb, change and recreate various aspects of the visual-spatial world. Visual-spatial intelligence is related to the ability to accurately capture color, direction, and space so that intelligence can help students in the learning process related to space, especially geometry material (Musfiroh, as cited in Arnis & Syahputra, 2020). Visual-spatial intelligence was chosen to be optimized because geometry material is still considered difficult for students, especially in online learning (Khoerunnisa et al., 2021).

Geometry is a branch of mathematics closely related to the science of lessons that discuss points, lines, planes, shapes, properties, sizes, and their relationship to each other. Geometry material can help students gain confidence in their mathematical abilities, become good problem solvers, communicate mathematically, and reason mathematically. Geometry material occupies a unique position in the mathematics curriculum, which presents abstractions from visual and spatial experiences, such as fields, patterns, measurements, and mapping (Nari, 2016).

Based on data from (Puspendik, 2019) regarding the analysis of the percentage of mastery of math problem material in the Computer-Based National Examination of Vocational Schools for the 2018/2019 academic year in Tasikmalaya district, it shows that geometry and trigonometry materials get a fairly low percentage of 29.27% compared to 35.24% Algebra material and Statistics 40.75%. Likewise, the percentage of geometry and trigonometry material at SMK Islam Madani of 30.61% is included in the material achievement, which is relatively low. Moreover, geometry and trigonometry material has seven items, far fewer than Algebra and Statistics material. Then, based on research conducted by (Sirri, 2021), students have difficulty solving problems related to the concept of building space. Therefore, this research aims to produce comic media assisted by SAC and analyze the effectiveness and quality of using comics media in optimizing students' visual-spatial intelligence.

Research Methods

The type of research used is R & D (Research & Development), oriented to researching, designing, producing, and testing the resulting product's validity (Sugiyono, 2018). Development is a process of creating or innovating new products that previously have been created that can be designed, developed, utilized, and evaluated according to the needs of students. As for what will be developed in this research, comic media assisted by Smart Apps Creator on geometry material of flat side space. The development model used in this study is a 4D (Define-Design-Develop-Disseminate) model. This study uses questionnaires, interviews, and tests of visual-spatial intelligence as the data collection techniques. The instruments in this research are teachers' and students' response questionnaires and visual-spatial intelligence test questions. This research was conducted in class XI Multimedia SMK Islam Madani. The data analysis technique in this study is to describe the results of teaching quality, presenting in graphic form the results of the teacher and student response questionnaires and calculating the results of the questionnaire with the effect size.

Result and Discussions

The main result of this research and development is an android-based learning media (application) named COMATH. This research and development is carried out using a 4D development model, which includes four stages, namely: define (definition), design (design), develop (development), and disseminate (dissemination). The results of each stage of the research procedure are as follows.

Define

In the context of developing teaching materials (modules, books, worksheets), the definition stage is carried out by:

(1) Curriculum Analysis
At this stage, the researcher collects information about the curriculum applied at SMK Islam Madani, namely the integrated curriculum, as stated in document 1 KTSP SMK Islam Madani. The material used in this study is geometric geometry.

(2) Analysis of student characteristics
Based on the results of initial observations conducted at SMK Islam Madani with Mathematics teachers, it was stated that the characteristics of students majoring in multimedia are: able to observe, form, and use images as a process of remembering, enjoy learning with graphics or visual form tools, interested in careers such as architects, designers, and also careers that use visual abilities. In the multimedia department, it is closely related to images and visualization. This can be seen from the results of the second-semester report cards for the 2021/2022 academic year, with an average score of 85, which is relatively high.

Then the product selection in the form of an android-based comic media that was developed took into account the results of interviews and a questionnaire analysis of the needs for the development of learning media filled out by mathematics teachers and students at SMK Islam Madani. Based on the results of questionnaires and interviews with teachers, some information was obtained that in learning activities, teachers only use learning media in the form of textbooks, which causes students to be less enthusiastic in the learning process. Then the teacher has never used android-based learning media or even developed it, so it supports researchers to develop android-based learning media.
Furthermore, from the results of the analysis of the needs for the development of learning media filled in by students, it was found that 87% of students still did not understand the mathematics learning material with the media used. Students are interested in learning to

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use android-based learning media because 100% of students already have smartphones and often use them in the school environment. Therefore, it is necessary to develop android-based learning media on geometrical material to optimize visual-spatial intelligence. Furthermore, this learning media can be used by students when outside the school environment so that students can create independent learning.

(3) Material Analysis

In learning mathematics, especially in spatial material, students have difficulty understanding visual and abstract material. It can be seen from the average score of the students' mathematics test, which is 65, which is low because it is below the KKM. The difficulty of these students is supported by the lack of use of learning media. The teacher only has one textbook in learning, so explaining the material is very limited. This can be seen from the presentation of images that are not clear and not yet interactive, so students have difficulty understanding the concept of the material. Therefore, the content in the learning media collaborates with comics so that learning becomes more interactive and combines with visual-spatial intelligence.

(4) Formulating Goals

Before writing teaching materials, the learning objectives and competencies to be taught need to be formulated first. It is helpful to limit researchers to avoid deviating from the original goal when writing teaching materials.

Formulating learning objectives is obtained from analyzing the needs of teachers and students, where the focus of the learning objectives in this study is on the geometry of geometric materials. The purpose of learning, in this case, is to analyze and solve problems related to geometrical geometry to optimize students' visual-spatial intelligence.

Design

Activities carried out at this stage include:

(1) Selecting learning media following the material and characteristics of students.

The selected learning media is an Android-based learning media that naturally contains comics as teaching materials. Researchers have made an initial product (prototype) or product design in the design stage. In developing teaching materials, this stage is carried out to make modules or textbooks per the content framework of the results of curriculum and material analysis. In developing a learning model, this stage is filled with activities to prepare a conceptual framework for learning models and tools (materials, media, evaluation tools) and simulate the use of these learning models and tools in a small scope. Before the product design proceeds to the next stage, the product design (model, textbook, Etc.) needs to be validated. Product design validation is carried out by colleagues such as lecturers or teachers from the same field of study/field of expertise. Based on the results of the peer validation, there is a possibility that the product design still needs to be improved according to the validator's suggestions. Simulating the presentation of material with the media and learning steps that have been designed. During the learning simulation, peer assessment is also carried out

(2) Developing criteria tests as the first action to determine the initial abilities of students and as an evaluation tool after the implementation of activities

At this stage, the researcher started by preparing visual-spatial intelligence test questions. The results obtained are: validation questionnaires given to material experts and media experts, response questionnaires for students and teachers to determine the attractiveness of students and teacher assessments of the products that have been developed, as well as visual-spatial intelligence test questions given to students at the pre-test and post-test. After

that, the researchers analyzed the scope of the spatial material and visual-spatial intelligence questions obtained from various sources following the predetermined learning objectives.

Develop

This stage begins with identifying the components of the application. These components include backgrounds, animations, icons, and menu features. The software used in developing this android-based learning media is Smart Apps Creator, supported by other software, namely Coreldraw and Zoom Meeting, which have their respective functions. The researcher use: Coreldraw to create backgrounds, menu features, icons, comics, and some spatial images; Zoom Meeting software to connect and interact virtually; and SAC to develop android-based learning media so that it becomes an application. The researcher's consideration in choosing the software is because it has various exclusive features and has ease of use and manufacture of learning media developed by researchers.

The next thing to do is to determine the formats needed in developing android-based learning media, explained as follows.

(1) Font type

The typeface used in the android-based learning media in this geometric geometry material uses several types of letters. Their use is located in different parts, as listed in Table 1.

Table 1. Font type and Layout

No	Font type	Used on-
1	Comic Sans MS	Comic
2	Century Gothic	Sample Questions, Practice Questions, Games, and Online Classes
3	Scratch Boys Textured [Embedded]	Profile, Material Menu, Sample questions, Games, Practices, and Online Classes

(2) Background color

The background used by the researcher in this comic learning media was obtained from freepik.com, which the researcher then modified with the help of CorelDRAW 2021. This background uses five different primary colors, where a combination of purple and blue is used on the initial display, the main menu, and the menu. In addition, the game uses a combination of orange and yellow colors.

(3) Icon

The icons researchers use on each button in this comic learning media are mainly obtained from freepik.com. Moreover, the rest of the researchers drew their own icons with the help of CorelDraw 2021.

After going through the above stages, the researcher started making applications, including inserting, editing, testing, and publishing so that a comic learning media was obtained on building material to optimize students' visual-spatial intelligence in the form of applications. The initial display or start page will appear first when using the learning media. This start page is the title of the material in the learning media and will automatically switch to the main menu or home when the user clicks the “mulai” button.

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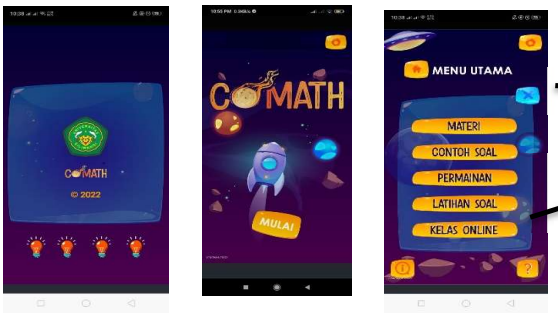
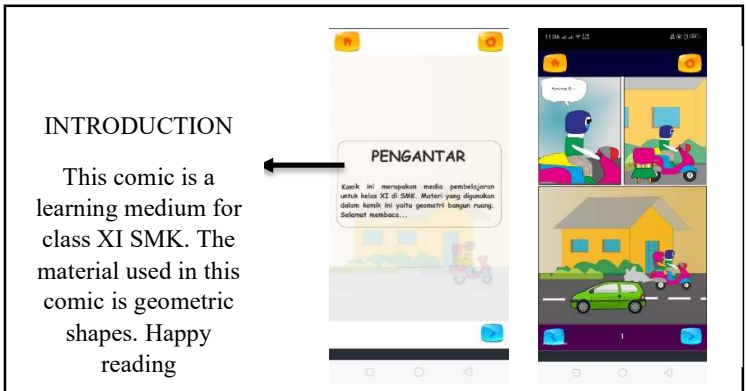


(a) (b) (c)

Figure 1a,b,c. Display of COMATH Start Page and Main Menu

The "Materi" menu contains learning materials for geometric geometry. This menu is used if the user wants to study material consisting of surface area and volume of spatial figures and visual-spatial intelligence. The display of the Material menu can be seen in Figure 2.



(a) (b)

Figure 2a,b. The display of COMATH "Materi" menu

The "Contoh Soal" menu is used when learning media users want to see examples of questions from previously studied material along with their solutions, including visual-spatial intelligence questions that have a goal so that users can learn. The sample question menu display can be seen in Figure 3.

(a) (b) (c)

Figure 3a,b,c. The display of "Contoh Soal" menu

The "Permainan" menu is used when media users want to hone their visual intelligence and entertainment, so they do not get bored. This game consists of 5 levels, from easy to difficult levels. The game menu display can be seen in Figure 3.

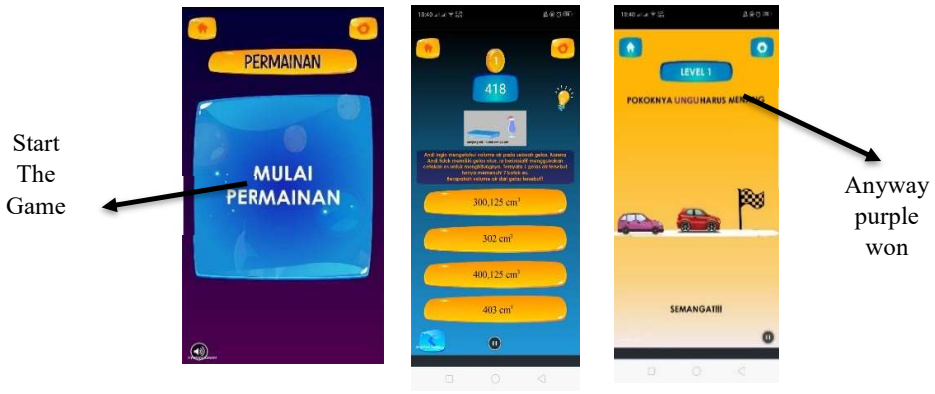


Figure 3a,b,c. The display of "Permainan" menu

The "Latihan Soal" menu is used if the learning media user wants to test visual-spatial intelligence and the ability to understand geometrical material consisting of 7 multiple-choice questions. The display of the Practice Questions menu can be seen in Figure 4.

INSTRUCTION

1. There are 7 questions with multiple answer choises
2. The time given to do all the questions is 7 minutes or 420 seconds
3. Us the icon below to view answer prompts
4. In the first number you can change the answer before going to the next number

Figure 4. The display of "Latihan Soal" menu

Furthermore, the last menu is the "Kelas Online" menu which contains information on meeting schedules virtually via zoom meeting, where the link is already listed on the menu. The "Kelas Online" menu display can be seen in Figure 5.

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Figure 5. The display of "Kelas Online" menu

When the making of this learning media is complete, then it is displayed to media experts to provide an assessment of the products that have been developed in accordance with their fields. In the validation questionnaire, the researcher provides a place for experts to provide criticism, suggestions, and comments on the learning media that has been developed, and then the researchers use it as material for product improvement. This media expert validation consists of 2 people with the following criteria: (1) Experienced in their field; (2) Minimum S2 education or currently pursuing Masters Education. In addition, expert validation is also carried out by practitioners, namely SMK Multimedia teachers with the following criteria: (1) Experienced in their field; (2) Minimum education S1; (3) Being an SMK Multimedia teacher. The results of media expert validation are as follows.

(1) Media Expert Validation

The assessment of these two media experts aims to measure the feasibility level of android-based learning media before being used for field trials. The results of the assessments from two media experts related to layout, color combination, font size, text legibility, back sound, audio clarity, video display attractiveness, button placement, button functionality, and media practicality are valid. However, there are suggestions in the Material menu regarding the accuracy of choosing the typeface used and the setting button in the main menu, so it needs to be improved.

Table 2. Media Expert Validation Improvement Suggestions

No.	Validator	Suggestions	Results
1	Validator 1	Choose a non-monotonous background.	Backsound has been fixed.
2	Validator 2	1. It is better to choose the typeface in comices; try using "comic sans MS". 2. Remove the music on/off button in each menu because there is already a play/pause shortcut on each interface.	1. Font has been fixed and changed to "Comic Sans MS" typeface. 2. The music on/off button in each menu has been removed.

Based on table 2. Suggestions and comments from media expert validators to improve the font and music settings menu. Responding to suggestions from the validator, the researchers then made improvements by changing the font in the comic section and removing the music settings button on each menu.

(2) *Limited trials in classroom learning, according to the actual situation that will be faced*
After the product is declared valid and feasible based on the validation results of material experts and media experts, the product will be tested using small groups, namely three mathematics teachers and five students of class XI SMK Islam Madani. The trial was carried out to see the initial response of teachers and students to the android-based learning media that the researchers developed. The trial was conducted on September 20, 2022. First, students and teachers install the learning media application then the researcher gives time to explore the learning media, after which the user fills out the response questionnaire that has been given. The following are the results of small group trials based on the results of the teacher and student response questionnaires:

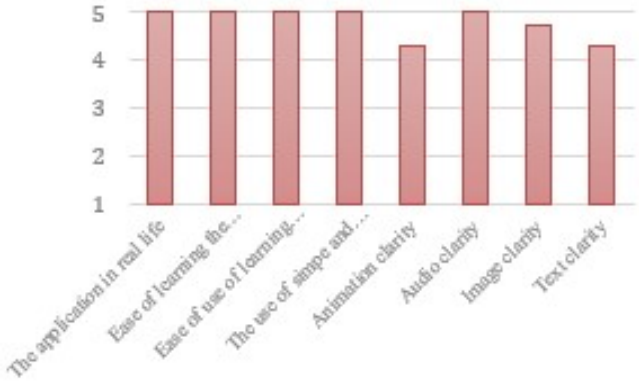

Figure 6. Teacher Response Questionnaire

Seen in Figure 6., the graph of the average scores of the assessment given by the teacher are: for the text and animation clarity indicator, it gets a score of 4.3 with a good category; indicators of image clarity and use of simple and easy-to-understand language got a score of 4.7 with the good category; on indicators of audio clarity, ease of learning the content of material, ease of use of learning media and application in real life get a score of 5 with a very good category.

Based on the calculation of the teacher's response questionnaire results, a score of 115 was obtained with a very good interpretation. This interpretation means that the learning media that has been developed is exciting so that it can be used in the learning process, especially on geometry material. In addition, several inputs/suggestions and comments need to be considered, including 1) the size of the letters in the comics is not precise; 2) The picture in the practice questions is unclear. Input/suggestions and comments from the teacher have been considered and discussed with the teacher during the product revision process.

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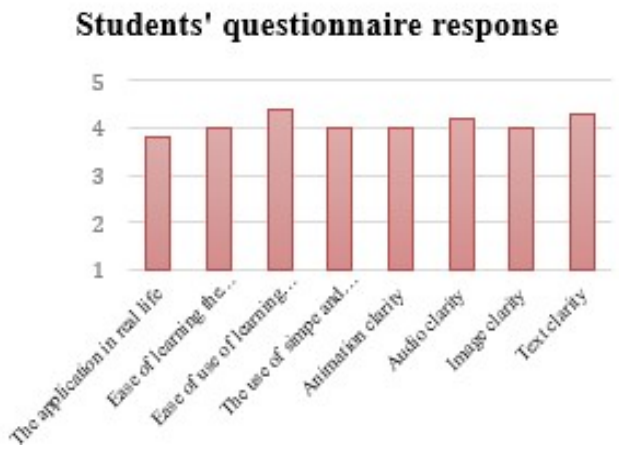

Figure 7. Student Response Questionnaire

It can be seen in Figure 7, the graph of the average score of the assessment given by the students are: for indicators of clarity of text, audio, animation, use of standard and simple language and ease of learning the content of the material, it gets a score of 4 in the good category; the image clarity indicator scored 4.2 in the good category; the indicator of ease of use of learning media obtained a score of 4.4 with a good category, and; the indicator of the application of the material in real life gets a score of 3.8 with a sufficient category.

Based on the calculation of the results of the student response questionnaires that have been carried out (see Appendix 7), a total score of 162 was obtained with a good interpretation. This interpretation means that the learning media that has been developed is good enough to be used in the learning process. Students comment that the media is exciting and can motivate them to continue learning.

(3) Revise the model based on the test results

At this stage, the researcher revised the learning media suggested by the respondents. Therefore, the suggestions/inputs from the trial results limited to 3 mathematics teachers and five students of class XI SMK Islam Madani are as follows.

a) The size of the letters in the comics is not clear and legible, so the researcher made improvements by adding the Zoom in Zoom out feature so that the material in comic form is readable.
b) The picture in the exercise question is not clear, so the researcher made improvements by replacing the picture in the exercise with a clearer one.

(4) Implementation of the model in a broader area

At this stage, product trials were carried out on all students of class XI Multimedia at SMK Islam Madani, totaling 25 students. Product trials are learning media trials that have been repaired or revised.

The results of the completed student response questionnaires are listed in Figure 8 below.

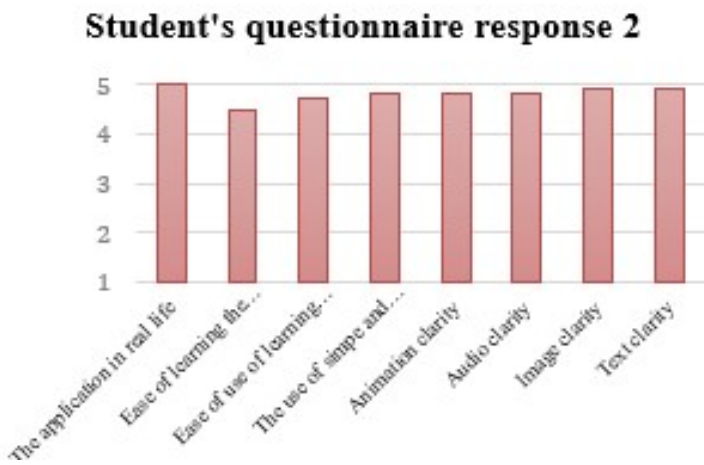

Figure 8. Student Response Questionnaire 2

Based on the calculation of the results of the student response questionnaires that have been carried out (can be seen in Appendix 7), a total score of 916 was obtained with a very good interpretation. This interpretation means that the learning media that have been developed are good in attractiveness and practicality. Students commented that the learning media was quite good and exciting, but this learning media application could not be downloaded on some smartphones. Then the material presented in the media is also quite understandable.

Disseminate

At this stage, the learning media is socialized and disseminated to three mathematics teachers at SMK Islam Madani. The following is a documentation of Disseminate Android-based comic learning media activities that the researcher provides.

Figure 9a,b,c. Learning Media Disseminate Activities

After the 4D stage was completed, the researchers then conducted an Effect Size Test to determine the effectiveness of the students' spatial abilities after using android-based learning media on spatial building materials. This effectiveness test uses the Effect Size formula according to Cohen (York, 2018) for one research class.

It is known that during the pretest 32% of students could only answer one question correctly while the other 68% of students failed to answer the questions on the spatial ability test. But at the time of the posttest it was seen that 84% of students experienced progress with increasing test scores. The maximum score in this visual-spatial intelligence test is 4.

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At the time of the pretest working on visual spatial intelligence number 1, as many as 100% of students were not able to answer the problem correctly, while at the posttest, as much as 68% of students were able to answer the problem correctly. Students think that the use of comic media with SAC makes it easier to learn material, especially geometry material. Furthermore, during the pretest on working on visual spatial intelligence number 2, as many as 100% of students were not able to answer the problem correctly, while at the time of the posttest, as much as 48% of students were able to answer the problem correctly.

Then at the pretest working on visual spatial intelligence number 3, as many as 100% of students were not able to answer the problem correctly, while at the posttest, as much as 60% of students were able to answer the problem correctly. Furthermore, during the pretest on working on visual spatial intelligence number 4, as many as 32% of students were able to answer the problem correctly, while at the posttest, as much as 92% of students were able to answer the problem correctly. Students consider the use of Android-based learning media using SAC to make it easier for students to answer problems related to visual-spatial intelligence.The following is a description of the calculation of the effect size of students' spatial abilities after using learning media:

- $mean\ of\ posttest = 1{,}08$
- $mean\ of\ \mathrm{p}retest = 0{,}32$
- $standard\ deviation\ of\ pretest = 0{,}48$

$$ES = \frac{mean\ of\ posttest - me\quad of\ pretest}{standard\ deviation\ of\ pretest}$$

$$ES = \frac{1{,}08 - 0{,}32}{0{,}48}$$

$$ES = 1{,}58$$

Based on the results of these calculations, the effect size value is 1.58, with the interpretation of a Strong Effect. It means that the visual-spatial intelligence of students is included in the category of a high level of effectiveness after students learn to use the product that the researcher developed, namely android-based learning media on geometry material. The visual-spatial intelligence of students has high effectiveness due to the novelty of the learning media used in the form of applications, learning materials in the form of comics, and sample questions and their discussions. Based on the student questionnaire responses, it stated that with comic media assisted by Smart Apps Creator, students felt that the material presented was easier to understand. Moreover, android-based learning media can increase learning motivation, make learning more exciting and fun, and influence learning outcomes (Yektyastuti & Ikhsan, 2016). In addition, the learning materials used in this study are packaged in comic form. In this study, the teacher's response to comic media assisted by Smart Apps Creator is that the media used can provide convenience for students in understanding the material and motivate students in learning. Comic digital learning media can improve student learning outcomes by achieving an average score of 83.60 with the criteria of student completeness of 93% (Narestuti et al., 2021). In the example questions presented in the media, they are not only limited to the fulfillment of basic competencies but are also equipped with questions of spatial visual intelligence and tips on how to solve them. In this study, the teacher's response to the visual-spatial intelligence of students was better able to mention concepts related to problems in the material of building space. According to (Rahmayanti et al., 2016), one way to improve visual-spatial intelligence is to provide innovations in delivering material, either in the form of practice questions in the form of pictures, games, the use of exciting tools and media, or the use of varied methods. It can make the visual-spatial intelligence of students increase.

Conclusion

Based on the results of the research, data collection, and data analysis, it can be concluded that this research produces comic media assisted by Smart Apps Creators on geometrical materials to optimize visual-spatial intelligence in the form of applications (.apk) that have been developed using 4D models. First, at the define stage, it is obtained that: 1) the curriculum used in SMK Islam Madani is integrated, 2) the learning media used in schools are textbooks, 3) students are more enthusiastic when learning using mobile phones or laptops, 4) the teacher has never made an android-based learning media because of the lack of information and supporting facilities, and 5) geometry material is one of the materials that get a fairly low average score. Secondly, at the Design stage, the researcher makes a prototype and makes research instruments. Then, at the Develop stage, a learning media in the form of an application is produced, which is in the valid/appropriate category for use by vocational students. The responses of teachers and students were very good based on the results of large and small group trials. After that, the researcher conducted a post-test to determine whether the media used could optimize visual-spatial intelligence. It was known that the average post-test value was more significant than the average pretest value. Finally, at the Disseminate stage, the researchers conducted socialization of learning media to mathematics teachers at SMK Islam Madani. The quality of the effectiveness of the visual-spatial intelligence of students after using comics learning media on geometry material gets a value of 1.58 with the "strong effects" criteria so that learning media is effectively used in learning.

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