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# Development of Android-Based Interactive Learning Media with STEM Nuances to Improve Creative Thinking Skills of Grade VIII Students

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Abstract

This research aims to develop android-based interactive learning media with STEM nuances to improve students' creative thinking skills that are feasible and effective. The learning media was developed using iSpring software. This software is integrated with Microsoft Powerpoint which can make the learning media more interactive. The final form of learning media is an android application. The learning media is given STEM nuances and activities to facilitate students' creative thinking skills. STEM is a learning approach that connects science, technology, engineering, and mathematics. The indicators of creative thinking skills used are fluency, flexibility, originality, and elaboration. The development model used in this research is 4D (Define, Design, Development, Disseminate), but only up to the development stage. This research produces android-based interactive learning media with STEM nuances to improve the creative thinking skills of junior high school students in grade VIII that are feasible and effective. Media and material validation respectively obtained a score of 91.5% and 91.2% which included a very feasible category. The effectiveness of the media is shown in the improvement of students' creative thinking skills. The N-Gain test obtained shows that the increase in students' abilities has increased which is classified as moderate.



## 1. Introduction

Technology in industry 4.0 is developing rapidly. Many sectors have advanced technology to improve the quality of their work. In the education sector, we also seen the use of technology to support learning. Especially when the covid-19 pandemic hit, the use of technology became one of the ways that the teaching and learning process still be carried out. After learning can be carried out normally again, the use of technology is also expected to continue to develop to improve the quality of learning.

One of the learning support facilities that can be developed with technology is learning media. The use of learning media aims to stimulate students so that they can receive the information provided and follow the learning well (Rafiq et al., 2017). Unfortunately, learning media that are only obtained from the internet have limitations and are less varied so that teachers are more likely to use textbooks or lecturing methods (Suryani et al., 2018). The researcher interviewed one of the junior high school teachers, the teacher said that in his school she rarely uses technology-based media because not all classes have supporting facilities such as projectors. Whereas the use of learning media can attract students to participate in learning so that students understand the material and minimize student misinterpretation (Budiman et al., 2021). Especially in mathematics learning which is often considered difficult by students.

Mathematics learning can develop logical, systematic, critical and creative thinking skills. Rachmantika & Wardono (2019) revealed that in mathematics learning, students' abilities are more focused on mathematical abilities, not just counting abilities. Especially in the industrial era 4.0, many abilities need

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to be improved. One of the abilities needed is 4C (Critical Thinking, Creativity, Communication, Collaboration). Creativity has a relationship with creative thinking.

In Indonesia, creative thinking skills are relatively low. Based on the 2015 Global Creativity Index (GCI) score, Indonesia is ranked 115 out of 139 countries (Florida et al., 2015). Indonesia's creativity index is only 0.202, very far compared to the first ranked country, Australia with an index of 0.970. In addition to the GCI, there is also the Creative Class Share (CCS) which is used to see the level of creative thinking. Indonesia is also at the bottom of the rankings, ranking 86 out of 93 countries with a CCS value of only 7.95 (Florida et al., 2015). According to Kemendikbud (2019), Indonesian students are only able to answer PISA level 1 questions according to the PISA results obtained. Therefore, questions that require creative thinking and logic skills, namely levels 4, 5 and 6, have not been able to be solved by Indonesian students. The researcher also collected preliminary data by giving questions related to creative thinking skills to one class VIII at SMP N Negeri Semarang. The results obtained show that students' creative thinking skills are still low.

Based on this problem, we need learning media that can awaken students' creative thinking skills. One of the applications used to create technology-based learning media is iSpring. This learning media made with Microsoft Powerpoint will be interactive and more interesting for students so that they can understand the material (Nery et al., 2021). In order for the media to be more interesting, STEM nuances are added to it. According to Vikram and Magued cited by Octaviyani et al., (2020) the STEM (Science, Technology, Engineering, and Mathematics) approach in the learning process can stimulate students to design, develop and utilize manipulative and affective, which may improve creative thinking skills. Ejiwale (2013) stated that teachers can be helped to deliver material in an interesting and different way by integrating STEM in learning.

Therefore, the researcher intends to develop an android-based interactive learning media with STEM nuances to improve creative thinking skills. It is hoped that students can improve their creative thinking skills so that they can use their creativity to solve everyday problems.

## 2. Methods

This study used the Research and Development (RnD) method. The development model used was 4D (Define, Design, Development and Disseminate) developed by Thiagarajan in 1974 (Sugiyono, 2015). The 4D model used has been modified into 3D, which means that the stages of this model used are Define, Design, Development. This is due to the limited time and cost to do the Disseminate stage. The data collection techniques used were questionnaires and tests. The questionnaire consists of a media feasibility validation instrument and a student response instrument. The tests used were pretest and posttest. The test technique was used to obtain data on students' creative thinking skills. The analysis technique used is the analysis for validation instruments and analysis of test results. The feasibility test results are described according to the percentage of scoring results which can be seen in Table 1. To describe student responses, the criteria used are in accordance with Table 2. The formula used in determining the percentage of scoring results is as follows (Niam & Asikin, 2020):

$$P = \frac{f}{N} \times 100\%$$

**Table 1.** Learning Media Feasibility Criteria.

| Percentage of Validity | Criteria |
|---|---|
| $1\% < P \leq 50\%$ | Not Feasible |
| $50\% < P \leq 70\%$ | Feasible Enough |
| $70\% < P \leq 85\%$ | Feasible |
| $85\% < P \leq 100\%$ | Very Feasible |

Source: Niam & Asikin (2020)

**Table 2.** Students' Response Criteria.

| Percentage | Criteria |
|---|---|
| $75\% < P \leq 100\%$ | Very Good/Very Interesting |
| $50\% < P \leq 75\%$ | Good/Interesting |
| $25\% < P \leq 50\%$ | Good Enough/Interesting Enough |
| $0\% \leq P \leq 25\%$ | Not Good/Not Interesting |

Source: Sugianto et al., (2018)

After the validation results show that the learning media is feasible, the media can be used in the learning process. Before learning the students were given a pretest and after learning the students were given a posttest. The pretest-posttest results from the control group and experimental group were analyzed using the prerequisite test, t-test and N-Gain test to determine the improvement of their creative thinking skills.

## 3. Results & Discussions

### *3.1. Result*

The results of this development research are interactive mathematics learning media android based on STEM nuances on the tangent material of the two circles of grade VIII junior high school. The results of the research conducted include media feasibility tests consisting of the results of media and material validation by validators, the results of students' responses to the media, and the results of the analysis on the effectiveness of the media on the creative thinking skills of the tested VIII grade students.

#### 3.1.1 Define

Learning activities at the school used for research rarely use technology-based learning media. The results of the teacher interview showed that students lacked motivation towards mathematics. In the same way, according to the researcher's observation, some students did not pay attention to the teacher and could not answer the questions asked by the teacher. In the initial test conducted by the researcher, the average score of the test was 54.4. The average score is still below the Minimum Criteria of Mastery Learning at the school. This initial test is related to creative thinking skills. In addition, most of the students' answers have not been resolved correctly and the explanation of their answers has not been detailed. This means that students' fluency and elaboration indicators are still lacking. Therefore, it can be said that these VIII grade students do not have good creative thinking skills. After that, compiling the material that will be used in the learning media. The material used is the Tangent Line of the Fellowship of Two Circles. The material is in accordance with the 2013 Curriculum for grade VIII. The learning media is given prerequisite material and is also associated with STEM.

#### 3.1.2 Design

The learning media developed is in the form of an android app. This media is made using iSpring and Web 2 APK Builder. ISpring is an additional feature of Microsoft Powerpoint. Widyatyastuti cited by Nurfajriani et al., (2020) argued that iSpring can display interesting content because this device includes multimedia-based software that can insert various forms of media such as videos, images, sounds, animations, and quizzes. Meanwhile, Web 2 APK Builder serves to convert files from iSpring in the form of HTML into APK format that can be installed on android phones. This learning media is developed with an attractive appearance that attracts students, and is matched with the material taken. The media created is called the GSPDL app. Figure 1 is the appearance of the application on a smart phone.

a


b


**Figure 1**. (a) Main Menu; (b) Material Sub Menu.

3.1.3 Development

Development consists of (1) expert assessment to obtain the results of the feasibility of learning media; and (2) trials to analysis the effectiveness of learning media.

3.1.3.1 Expert Assessment

The feasibility test aims to determine how much feasibility of interactive learning media with STEM nuances. This expert assessment is a learning media feasibility test consisting of media and material validation. Therefore, there are two instruments, namely material and media validation sheets. In Table 3 and Table 4 below are the results of validation by the three validators.

**Table 3.** Data on Material Validation Results.

| Aspects assessed | Validators | | | Percentage Score (%) | Criteria |
|---|---|---|---|---|---|
| | D1 | G1 | G2 | | |
| Content and Material Feasibility | 51 | 47 | 44 | 91 | Very Feasible |
| Presentation Feasibility | 20 | 18 | 17 | 91.6 | |
| Final Score (%) | 98.6 | 90.3 | 84.7 | | |
| Final Score Average | | 91.2 | | | |

**Table 4.** Data on Media Validation Results.

| Aspects assessed | Validators | | | Percentage Score (%) | Criteria |
|---|---|---|---|---|---|
| | D1 | G1 | G2 | | |
| Software Engineering | 20 | 18 | 18 | 93 | Very Feasible |
| Visual Communication | 38 | 35 | 36 | 90.8 | |
| Final Score (%) | 96.7 | 88 | 90 | | |
| Final Score Average | | 91.5 | | | |

Based on Table 3 above, the average final score of material validation is 91.6%, which means that the material in the learning media is classified as very feasible. In accordance with Table 4, the average media validation score is 91.5%, which means it is included in the very feasible category. Therefore, it can be concluded that the interactive learning media based on android with STEM nuances is very feasible in terms of material and media. So, the learning media can be used for the teaching and learning process after making improvements according to the suggestions of the validators.

3.1.3.2 Usage Testing

Interactive learning media based on android with STEM nuances that have been made and have gone through the validation stage of experts then enter the trial use stage. Researchers used an experimental group and a control group. Before the use of interactive learning media in the experimental group, both classes were given a pretest to determine their initial abilities. After that, the experimental group was given learning treatment using interactive learning media based on android with STEM nuances, while the control group was not. After the material was taught, both classes were given a posttest to determine the improvement of their creative thinking skills. In addition, after the experimental group passed the learning using the next media, a student response questionnaire was given. The average score of this student response questionnaire is 80%, which means that the interactive learning media based on android with STEM nuances is included in the very good/interesting category.

After the trial use of interactive learning media based on android with STEM nuances is carried out, then the acquisition of student scores from the pretest and posttest were analyzed. First, the pretest and posttest results from the experimental group and control group were tested for normality. The normality test was carried out with the Kolmogorov-smirnov test using the help of SPSS 21. It is said that $H_0$ can be accepted if the $sig. > \alpha = 0.05$ (Sukestiyarno, 2020). The experimental group pretest results have a $sig. = 0.88 > \alpha$ which means that the experimental class pretest data is normally distributed. The experimental group posttest results have a $sig. > 0.05$ value so it can be said that the data is normally distributed. The control group pretest data has a $sig. > 0.05$ value which means that the data is also normally distributed. In addition, the control group posttest data is also normally distributed because it has a $sig. = 0.2 > 0.05$ value. Therefore, it can be concluded that $H_0$ is accepted which means that all data are normally distributed.

The pretest results of the experimental group and control group were tested for the equality of the two averages, namely the one-party test obtained $t_{count}$ which is 0.77. The t-table value at a significant level of 5% is 2.057. Because the value of $t_{count} = 0.77 < t_{table} = 2.057$ then $H_0$ is accepted. Thus, the

conclusion is that the average pretest score of the experimental class is the same as the control class. It shows that the initial ability or initial condition of both classes is the same. Then, the posttest scores of the experimental and control classes were also tested for the similarity of the two averages, namely the one-party test. Based on the test results, the $t_{count}$ is 4.28. The t-table value at a significant level of 5% is 2.007. Because the value of $t_{count} = 0.77 > t_{table} = 2.007$ then $H_0$ is rejected. Thus, the conclusion is that the average posttest score of the experimental group is more than the control group. Finally, the N-Gain test was conducted to determine the increase in students' creative thinking skills. The N-Gain value of the pretest and posttest of the experimental group is 0.53 which is included in the moderate category. So, it can be concluded that students' creative thinking skills have increased with a moderate category.

After the experimental class went through learning using the next media, a student response questionnaire was given. The average score of this student response questionnaire is 80%, which means that the interactive learning media based on android with STEM nuances is included in the very good/interesting category.

### *3.2. Discussion*

Researchers used iSpring and Web 2 Apk Builder to create interactive learning media based on android with STEM nuances. The learning media created has a final form as an android application. This is in accordance with what is stated by (Handayani & Rahayu, 2020) that iSpring and APK Builder make the media more varied than using powerpoint alone, and can be published in HTML format which is then converted into an android application. In addition, users can operate the media according to their wishes, not stuck just watching or listening to the media. This is in line with (Suhirman, 2015) who states that interactive media is media that has a controller so that users can operate the next process according to their wishes.

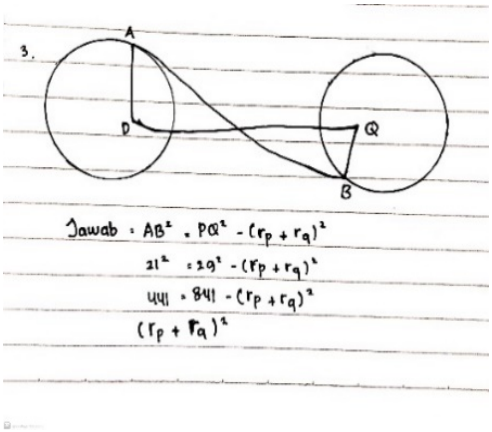
The activities in the learning media include questions and a platform for students to have their say. This is a modified iSpring quiz tool. This habit to have an opinion can facilitate students in developing creative thinking skills. This is in line with Jayanto & Noer, (2017) who stated that creative thinking is the ability to convey the possibility of diverse solutions according to the information obtained and can provide various opinions on a problem. In addition to being active in providing opinions, researchers also provide open ended questions at the end of each main activity on the learning media.

An example of STEM in this media is a bicycle chain. The bicycle chain was chosen because it relates to the tangent of the outer circle and STEM. The questions are given to raise curiosity and deepen students' STEM. The explanation of the bicycle chain is also associated with STEM aspects in accordance with the explanation of the National Research Council, US cited by Bahrum (2018), namely 1) science is learning about nature including about natural laws, 2) technology, including the entire system of people and organizations, knowledge, processes and tools used to make and use technology, 3) engineering is knowledge about designing and creating products 4) mathematics is learning related to patterns and relationships between shapes, numbers, and quantities. With this, this media meets several STEM characteristics expressed by Moore, Johnson, Peters-Burton and Guzey in Bahrum (2018), namely using meaningful learning and relating to students' real lives, implementing student centered learning so that students are actively involved in learning, training students to collaborate and communicate in learning activities.

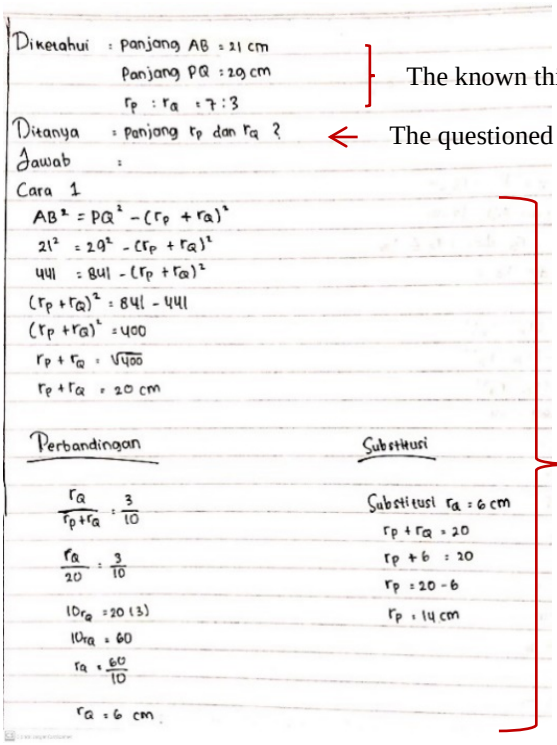
Providing illustrations on media related to the surrounding environment strengthens students' thinking to better understand or interpret the material provided. This is in line with (Suardipa, 2019) who revealed that creative thinking skills are needed because creativity connects everything, by looking at various points of view and looking around can create new thoughts. Giving problems in each activity on the learning media is also based on the model used is Problem Based Learning (PBL). (Nurdyansyah & Fahyuni, 2016) revealed that PBL is a learning innovation because students' thinking skills are optimized, so that students can empower, hone, test, and improve their thinking skills continuously.

Figure 2 below is the answer of one of the students regarding the indicator of creative thinking, namely fluency.

a




b




The known things

The questioned things

The answers

**Figure 2.** (a) Pretest Answer and (b) Posttest Answer of One Student on Fluency Indicator.

**Figure 2a:** Students have used the correct formula but can only input the known number.
**Figure 2b:** Students have solved the problem correctly an also wrote down the known and questioned things.

Figure 2 is the answer of one of the students who improved on the fluency indicator. In the pretest answer, the student stopped in the middle and could not solve the problem. Whereas in the posttest, he was able to solve the problem well, seen from the correct answers and neat writing. This shows that the student can fluently solve the problem with relevant answers. This is in line with the characteristics of the fluency indicator, that is the ability to express many relevant ideas and have a smooth flow of thought (Munandar, 2012).

## 4. Conclusion

Based on the results and discussion, it can be concluded that the interactive learning media based on android with STEM nuances is feasible and effective. This is because the expert assessment of the feasibility of the media has an average score of 91.35% in terms of material and media validation. The average final score of material validation is 91.2% and the average final score of media validation is 91.5%, both of which are included in the very feasible category. The average of the student response questionnaire score is 80% which means that the learning media is included in the very good/interesting category. In addition, the average posttest score of the class that used interactive learning media based on android with STEM nuances was better than the average posttest score of the class that did not use the media. Furthermore, the N-Gain test showed that there was a moderate increase in students' creative thinking skills.

## References

Bahrum, S. (2018). Integration of STEM Education in Malaysia and Why to STEAM. *International Journal of Academic in Business and Social Sciences*, *7*(6), 644–654. https://doi.org/10.6007/IJARBSS/v7-i6/3027

Budiman, I. A., Haryanti, Y. D., & Azzahrah, A. (2021). Pentingnya Media Aplikasi Android Menggunakan Ispring Suite 9 Pada Pembelajaran Daring Terhadap Motivasi Belajar Siswa. *In Prosiding Seminar Nasional Pendidikan*, *3*, 144–150.

Ejiwale, J. A. (2013). Barriers to Successful Implementation of STEM Education. *Journal of Education and Learning*, *7*(2), 63–74.

Florida, R., Mellander, C., & KIng, K. (2015). The Global Creativity Indeks 2015. *Martin Prospery Institute*, 53–60. http://martinprosperity.org/media/Global-Creativity-Index-2015.pdf

Handayani, D., & Rahayu, D. V. (2020). Pengembangan Media Pembelajaran Interaktif Berbasis Android Menggunakan ISpring san APK Builder. *MATHLINE: Jurnal Matematika DanPendidikan Matematika*, *5*(1), 12–26.

Jayanto, I. F., & Noer, S. H. (2017). Kemampuan Berpikir Kreatif dengan Pembelajaran Guided Discovery. *Seminar Nasional Matematika Dan Pendidikan Matematika 2017*, 245–255. https://doi.org/10.4324/9781315762470-33

Kemendikbud, B. (2019). Pendidikan di Indonesia: Belajar dari Hasil PISA 2018. In *Pusat Penilaian Pendidikan Balitbang KEMENDIKBUD*. Balitbang Publisher.

Nery, R. S., Sunardi, & Aprizal. (2021). Pengembangan Media Pembelajaran Interaktif Berbasis Android Menggunakan iSpring Untuk Materi Penyajian Data Di Kelas VII Sekolah Menengah Pertama. *Jurnal Penelitian Pendidikan Matematika*, *5*(2), 112–124.

Niam, M. A., & Asikin, M. (2020). *The Development of Science, Technology, Engineering, and Mathematics (stem)-Based Mathematics Teaching Materials to Increase Mathematical Connection Ability*. *8*(1), 153–167.

Nurdyansyah, & Fahyuni, E. F. (2016). *Inovasi Model Pembelajaran* (1st ed.). Nizamia Learning Center.

Nurfajriani, Halimah, N., & Hajar, S. (2020). Pengaruh Multimedia ISpring Presenter Berbasis Problem Based Learning terhadap Berpikir Kreatif Siswa pada Laju Reaksi. *Seminar Nasional Kimia Dan Pendidikan Kimia*, 194–200.

Octaviyani, I., Kusumah, Y. S., & Hasanah, A. (2020). Peningkatan Kemampuan Berpikir Kreatif Matematis Siswa Melalui Model Project-Based Learning dengan Pendekatan STEM. *Journal on Mathematics Education Research*, *1*(1), 10–14.

Rachmantika, A. R., & Wardono. (2019). Peran Kemampuan Berpikir Kritis Siswa pada Pembelajaran Matematika dengan Pemecahan Masalah. *PRISMA, Prosiding Seminar Nasional Matematika*, *2*, 439–443.

Rafiq, M., Sabil, H., & Ramalisa, Y. (2017). *Pengembangan Media Pembelajaran Matematika Berbasis Pendekatan Saintifik dengan Powerpoint dan ISpring Suite pada Materi Perbandingan di Kelas VIII SMP Negeri 1 Kota Jambi*. 1–9.

Suardipa, I. P. (2019). Kajian Creative Thinking Matematis dalam Inovasi Pembelajaran. *Purwadita: Jurnal Agama Dan Budaya*, *3*(2), 15–22.

Sugianto, S. D., Ahied, M., Hadi, W. P., & Wulandari, A. Y. R. (2018). Pengembangan Modul IPA Berbasis Proyek Terintegrasi STEM pada Materi Tekanan. *Journal of Natural Science Education Reseach*, *1*(1), 28–39.

Sugiyono. (2015). *Metode Penelitian dan Pengembangan (Research and Development) untuk Bidang: Pendidikan, Manajemen, Sosial, Teknik*. Alfabeta.

Suhirman. (2015). Pemanfaatan Teknologi Multimedia dalam Pembelajaran Pendidikan Agama Islam. *MADANIA*, *19*(2), 215–223.

Sukestiyarno. (2020). *Olah Data Penelitian Berbasis SPSS*. Universitas Negeri Semarang.

Suryani, N., Setiawan, A., & Putria. (2018). *Media Pembelajaran Inovatif dan Pengembangannya*. PT. Remaja Rosdakarya.