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# Media Scratch Development on Coordinated Themes Cartesian Uses ADDIE Model

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## A B S T R A K

*Matematika merupakan mata pelajaran yang sangat penting di sekolah. Hal ini dikarenakan matematika berperan dalam menyelesaikan masalah sehari-hari. Salah satu mata pelajaran matematika adalah koordinat kartesius. Dalam pembelajaran matematika, pemanfaatan media pembelajaran masih rendah dan sebagian siswa masih kesulitan dalam mengerjakan soal koordinat kartesius. Solusi yang dapat digunakan untuk menyelesaikan permasalahan yang dihadapi siswa dan guru adalah dengan menggunakan aplikasi Scratch yang menampilkan gambar disertai penjelasannya. Penelitian ini bertujuan untuk mengetahui perancangan media pembelajaran Scratch dan juga mengetahui kemampuan siswa setelah menggunakan media Scratch tersebut. Model ADDIE memiliki lima tahapan yaitu Analyze, Design, Develop, Implement, dan Evaluate. Subjek dalam penelitian ini adalah tujuh siswa Kelas VII di salah satu SMP Negeri di Bandung. Hasil validasi oleh validator ahli materi, validator ahli media, guru, validasi User Acceptance Testing (UAT) dan juga pengguna menunjukkan bahwa media pembelajaran yang dibuat masuk dalam kategori layak untuk digunakan dalam proses pembelajaran. Setelah siswa melakukan pembelajaran menggunakan media Scratch, diperoleh nilai rata-rata output siswa sebesar 81,14. Berdasarkan skor tersebut, terdapat 6 dari 7 siswa yang dinyatakan memenuhi Kriteria Ketuntasan Minimal (KKM). Selain itu, pada perhitungan ketuntasan klasikal diperoleh sebesar 85,7%, sehingga dapat disimpulkan bahwa media pembelajaran ini sangat efektif.*

## A R T I C L E   I N F O

## A B S T R A C T

*Mathematics is a vital subject in school. It is because it plays a role in solving everyday problems. One of the topics of*

*mathematics is the cartesian coordinates. In mathematical learning, the use of learning media is still low, and some students still have difficulty working on cartesian coordinates. The solution that can be used to solve the problems that students and teachers face is to use the Scratch application, which displays images with explanations. The study aims to learn about Scratch learning media design and students' abilities after using Scratch media. The ADDIE model has five stages: Analyze, design, develop, implement, and evaluate. The subjects in the study were seven Class VII students from one of Bandung's secondary schools. Validation results by material expert validators, media expert validators, teachers, User Acceptance Testing (UAT) validation, and users show that the learning media created in the category deserves to be used in the learning process. After students perform learning using Scratch media, the average student output score is 81.14. Based on the score, 6 out of 7 students favored the Minimum Proficiency Criteria (KKM). Besides, the classical proficiency calculations were obtained at 85.7%, which can be concluded that the learning media is very effective.*

## 1. INTRODUCTION

Mathematics is an essential subject in school because it solves everyday problems. One of the mathematical subjects is the cartesian coordinate (Yulianisa & Sudihartinih, 2022). The cartesian coordinate is one of the maths that attempts to represent points on the field of cartesian based on a problem transformed into a mathematical representation corresponding to real life. (Setiyowati, et al.., 2023).

This material is more straightforward than other mathematical subjects, but some students struggle. Students' difficulties in solving the topic of cartesian coordinates are caused by various consequences, such as student misunderstanding of the concept (Fitriyah et al., 2020), misinterpretation of the subject, student error in drawing coordinate points and also drawing the coordinate symbols (Lango & Lede, 2022), and student error in determining the origin of coordinates or specific points. (Fitriatien, 2019).

During the learning process of mathematics, some teachers only use books as learning materials and are equipped with learning tools such as tablets and PowerPoints when teaching math. (Awalia, et al., 2019). Due to the limited use of mathematical learning media, most students still do not understand the concept and are also prone to being too lazy to work on it. (Dewi & Septa, 2019; Maharani, et al., 2018). One solution to this problem is the use of learning media. In mathematics teaching, the media is needed to communicate between teachers and students to clarify abstract concepts. (Suseno, et al.., 2020). Learning media can also support the success of learning processes (Ulfah et al., 2021). Teachers can use learning media to convey more meaningful learning through visualization. This is because students prefer the visuals to the teacher's writing, and they do not need to explain the lesson orally or in a lecture, so it can help students better understand the material they are teaching. (Kustiati, 2022).

In the twenty-first century, teachers should provide teaching materials that are consistent with the times' development. Teachers should also use ICT as an alternative to help students understand concepts (Muharni et al., 2021), as well as deliver learning materials that are fun, interesting, and relevant to the materials they want to be taught. (Ghufron, et al.., 2022; Kustiati, 2022). Scratch is a programming language that beginners can use to display animations, sounds, and images (Sutikno et al., 2019). In the cartesian coordinate material, the Scratch application is the most appropriate solution to solve problems faced by students and teachers as the Scratch app displays images and descriptions compared to GeoGebra. The Geogetra app only shows images, and the GeoGebra application is also challenging to use offline on Android. Scratches can be easily accessed online and offline (Chasannudin et al., 2022). Therefore, Scratch can be used on Android, students find it easier to use Scratch, and more students use Scratch than iOS.

Some studies on the development of mathematical learning media using Scratch are on the topics of the most significant federative factor (FPB) (Sudihartinih, et al.., 2021), algebraic overlapping (Yulianisa & Sudihartnih, 2022), the size of the triangle area (Novita & Rachmatin, 2021) and flat buildings (Muharram & Fajrin, 2021). Scratch is also used in other lessons, such as

physics (Intana et al., 2018) and science literacy. (Latip, 2022; Poobalan, et al.., 2019). Based on the research report, there has been research on android-based learning media design on the topic of point position against point of origin (0,0), and specific points (a,b) using the Scratch application by the author himself (Emanuela & Sudihartinih, 2023) but need to express further the process of development of such media. Therefore, the researchers will study the design of Android-based learning media using the Scratch application on point position against point of origin (0,0) and specific point (a,b).

## 2. METHODS

Research and Development is a process or measure to develop or improve an existing product, test the effectiveness of existing products, and develop and create new products. (Yuliani & Banjarnahor, 2021). The ADDIE model, pioneered by Branch, has five stages: Analyze, Design, Development, Implement, and Evaluate. (Fitriyah, et al.., 2020). Analysis is a phase in analyzing several problems encountered during the learning process, including the lack of adequate learning material and media. Design is the stage of choosing materials and designing storyboards.

The development stage is where learning materials are developed based on planned designs. In addition to developing scratch-based material, the validator also validates advice to improve the learning material produced. At this stage, validators include media experts, material experts, teachers, and UAT (User Acceptance Test). A user acceptance test is carried out to determine the user's response to a program test designed by distributing a raft containing open questions through Google Forms and conducting interviews. Implementation is a phase of experimental learning media conducted by conducting experiments on high school students—the implementation of learning media using a single-group pretest-posttest design. The research design begins with a pretest, provides a Scratch development treatment, and ends with a final test. (posttest). Evaluation in this research is a process evaluation as it is associated with the research and development stages to improve the product developed during the production of learning materials from the analysis stage to the implementation stage.

The participants in the study were seven male students from one of the schools located in Bandung City, West Java Province. The instruments used in this research are test instruments and non-test instruments in the form of unstructured interviews and lifts. The test instrument consists of pretes and postes. The test consists of five question descriptions representing each indicator of concept understanding. The Concept Understanding Indicator according to Mayasari & Habeahan (2021) mention indicators of concept understanding as follows: using images to help solve a problem, providing examples rather than examples for a concept, classifying examples into a concept; being able to apply similarities between concepts and procedures; understanding and using appropriate patterns for solving problems; applying similarities or differences to solve problems; able to explain solutions.

Data was obtained from the test results, and data analysis was performed using the following formula.

$$Value = \frac{Total\ score\ Obtained}{Ideal\ score\ total}\ x\ 100\%$$

The final score will be compared to the Minimum Compliance Criteria (MCC) values that apply in the school where the test is conducted. The number of students declared to be successful influences learning success. This learning success refers to classical accuracy. Classical accurateness can be obtained using the following formula.

$$Classical\ Intensity\ (KK) = \frac{Many\ strict\ students}{Many\ overall\ students}\ x\ 100$$

Classical intensity is the benchmark for the effectiveness of interactive learning media based on Scratch in developing the ability to understand concepts related to cartesian coordinates. Table 1 interprets the classical accuracy.

Table 1. Classical intensity

| Range Final Score | Criteria |
|---|---|
| KK > 80% | Very effective |
| 60% < KK < 80% | Effective |
| 40% < KK < 60% | Less Effective |
| \20% < KK < 40% | Ineffective |
| 0% < KK < 20% | Very Ineffective |

A Likert scale measures attitudes, opinions, and perceptions of individuals or groups related to social events. This study's Likert Scale uses five options based on scale levels. The data analysis uses the following formula to obtain results in the form of structured information.

$$Percentage\ Value\ = \frac{sum\ of\ scores\ obtained}{sum\ of\ ideal\ scores}\ x\ 100\%$$

The percentage to be calculated is determined in Table 3.5.

Table 2. Percentage of Achievement

| Range Final Score | Criteria |
|---|---|
| KK > 80% | Qualified |
| 60% < KK < 80% | Worth |
| 40% < KK < 60% | Quite qualified |
| \20% < KK < 40% | Less qualified |
| 0% < KK < 20% | Not qualified |

## 3. RESULT AND DISCUSSION
**Learning Media Design Process**

The following is the Scratch-based learning media design process using the ADDIE procedure:

a. Analysis

The analysis is the first preparation phase in developing the AD DIE model. Students face problems with cartesian coordinate material because some have not yet been able to draw cartesian coordinates, some are still confused about determining the point in the cartesian coordinate, and some are mistakenly writing the quadrant of cartesian coordinates. Students also have difficulty pointing to the position of a point in a particular point.

b. Design

At the planning stage, material selection and initial planning of the learning media are carried out by creating a storyboard for the game layout to be created. Storyboards are made in Microsoft Word and consist of five pages containing the opening view, introductory view, menu view, material view and material description, exercise view, and game view. Figure 1 shows some storyboard designs.

| VISUAL | SKETSA | AUDIO | VISUAL | SKETSA | AUDIO |
|---|---|---|---|---|---|
| Dalam frame ini terdapat background layer dengan resolusi 1024x768 dan 2 layer animasi | Animasi Judul<br><br>Animasi Penjelasan Aplikasi dan Kalimat Pembuka | Slow music dan Voice Over | Dalam frame ini terdapat background layer dengan resolusi 1024x768, teks judul, dan 1 layer animasi | Judul<br><br>Masukan Nama<br><br>Icon-icon yang berhubungan dengan konsep posisi titik | slow music ditambah dengan *voice over* |

Figure 1. Storyboard View

c. Development

At the stage of learning media creation, the learning media design corresponds to the storyboard design that has been created.
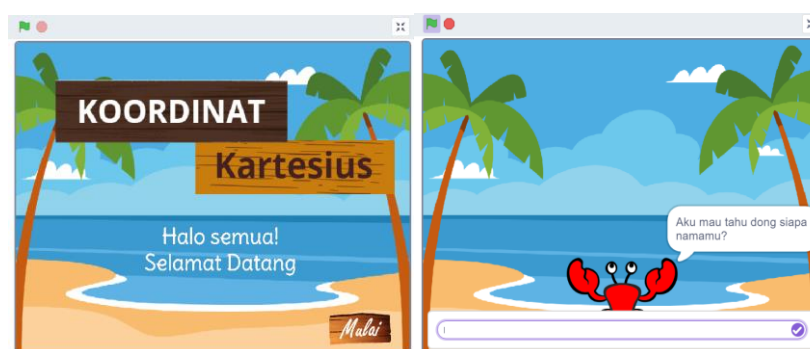


Figure 2. Scratch Media Appearance

The initial appearance of this game is shown in Fig. 2. Start the game by pressing the Start Game button and the opening speech. At this stage, not only are Scratch learning media created, but validation tests are also carried out by validators. To ensure that the developed learning media design is valid, validity tests are carried out by providing a validation lift. There are four validation tracks: media expert validation carrier, material expert validating carrier, and UAT validation Carrier. The following conclusions of the validation response to the validating expert carrier can be seen in Table 3.

Table 3. Media Validation Response

| Name | Media Validation | | |
|---|---|---|---|
| | Content | Technical | Instructions |
| Validator A | 80% | 80% | 80% |
| Validator B | 95% | 80% | 85% |
| Validator C | 80% | 80% | 90% |

Based on Table 3, it can be concluded that the learning media in content quality, instruction, and technicality are categorized as highly qualified. Table 4 shows the conclusion of the validation response to the lifting of validation experts.

Table 4. Materials Validation Responses

| Name | Materials Validation | | |
|---|---|---|---|
| | Content | Learning | Language |
| Validator A | 80% | 80% | 80% |
| Validator B | 95% | 80% | 90% |
| Validator C | 90% | 85% | 95% |

Table 4 shows that the learning media are decent in terms of content, instruction, and technical quality.

Table 5. UAT Response to Scratch Media

| Name | Understanding the concept | Visual of the Game | Button Functionality | Interest | Benefit | Language |
|---|---|---|---|---|---|---|
| L1 | + | + | - | + | + | + |
| L2 | - | + | - | + | + | + |
| P1 | - | + | + | + | + | + |
| P2 | + | - | + | + | + | + |
| L3 | + | + | - | + | + | + |
| L4 | + | + | + | + | + | + |
| L5 | + | + | + | + | + | + |
| P3 | + | + | - | + | + | + |
| P4 | + | + | + | + | + | + |
| P5 | + | + | + | + | + | + |
| P6 | + | + | + | + | + | + |
| P7 | + | + | + | + | + | + |
| Total | 10 | 11 | 8 | 12 | 12 | 12 |
| Percentage | 86,6% | 91,6% | 66,6% | 100% | 100% | 100% |
| Category | Very good | Very good | Good | Very good | Very good | Very good |

Table 5 shows that each element in the media category is excellent or highly qualified, and the students' response to the learning media is positive.

d.  Implementation

In the implementation phase, the researchers conduct a pre-test evaluation. After that, they learn to use the created Scratch learning media and evaluate the posts. Students' pre-test scores can be seen in Table 6.

Table 6. Student pre-response

| Name | Student Answer Score on Each Question | | | | | Total Score | Value |
|------|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | | |
| Student 1 | 5 | 0 | 5 | 0 | 0 | 10 | 40 |
| Student 2 | 5 | 0 | 0 | 0 | 0 | 5 | 20 |
| Student 3 | 1 | 0 | 5 | 0 | 0 | 6 | 24 |
| Student 4 | 0 | 0 | 3 | 0 | 0 | 3 | 12 |
| Student 5 | 5 | 0 | 0 | 5 | 0 | 10 | 40 |
| Student 6 | 5 | 0 | 3 | 0 | 0 | 8 | 32 |
| Student 7 | 5 | 0 | 0 | 5 | 0 | 10 | 40 |

Based on the results of Table 6, most students know the cartesian coordinate point and can determine examples based on different quadrants. However, many also do not know the quadrants and drawn points before using the learning media.

e.  Evaluation

At the evaluation stage, researchers ask research subjects to respond to responsive lifts and complete posts related to coordinating material in everyday life. Student post-score results can be viewed in Table 7

Table 7. Student Post Value

| Name | Student Answer Score on Each Question | | | | | Total score | Value |
|------|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | | |
| Student 1 | 5 | 0 | 5 | 5 | 5 | 20 | 80 |
| Student 2 | 5 | 5 | 5 | 5 | 3 | 23 | 92 |
| Student 3 | 5 | 0 | 3 | 0 | 0 | 8 | 32 |
| Student 4 | 5 | 5 | 3 | 5 | 5 | 23 | 92 |
| Student 5 | 5 | 5 | 5 | 5 | 5 | 25 | 100 |
| Student 6 | 5 | 5 | 5 | 5 | 0 | 20 | 80 |

| Student 7 | 5 | 5 | 5 | 4 | 4 | 23 | 92 |

The Minimum Testing Criterion (MCC) value that applies to the school where the research test is conducted, namely a score of 70, will be compared with the post-test results. Students are deemed to be qualified if their final score reaches the score of 70. Based on the results of Table 7, of the total students, the number of students who expressed commitment to learning success was 6, that is, 7. Considering the classical accuracy table, which can be found in Table 3.6, it can be concluded that the learning method is highly effective at 85.7% in improving the understanding of cartesian coordinate material.

**Elevate student response**

Table 8. Student response to Scratch media

| Name | Aspect | | | |
| --- | --- | --- | --- | --- |
| | Content | Language | Design | Interesting |
| Student 1 | 100 % | 40 % | 93 % | 60 % |
| Student 2 | 80 % | 100 % | 86 % | 73 % |
| Student 3 | 40 % | 50 % | 53 % | 40 % |
| Student 4 | 60 % | 100 % | 93 % | 93 % |
| Student 5 | 80 % | 80 % | 93 % | 53 % |
| Student 6 | 80 % | 60 % | 60 % | 73 % |
| Student 7 | 90 % | 90 % | 66 % | 93 % |

Table 8 shows that each element in the media category is qualified, and the students' response to the learning media is positive.

The following is the student's response based on the interview results:
1. Student 1 is already able to follow learning using self-developed media. When interviewed for student response purposes, the researchers had difficulty communicating with student one because the student has unique needs and language difficulties, which make it difficult for students to understand the material in the learning media.
2. Student 2 can already follow learning using the media developed independently. Because Student 2 is shy, researchers find it challenging to communicate with them during interviews for responses. The second student said that the learning media created was already appealing, the illustration was very helpful in understanding the material, the letter was very readable, the language was understandable, and Scratch media could understand the teacher's explanation.

3. Student 3 could already use learning media independently. In an interview for the responsive lift, student 3 stated that the Scratch medium was excellent and enjoyable. The user quickly understands the language used.

4. Students 6 are already able to use the learning media independently. In an interview for responsive raising, student 6 said that Scratch media is exciting with its easy-to-understand language. The illustrations can help the reader understand the material.

5. Students 7 say that learning in class using the Scratch medium so that students do not get bored while learning and only use printed books and PowerPoints. In an interview for the response lift, seven students said that the Scratch media was already good, with a language that was easy for the user to understand. However, he stated that the font size of the animated characters when speaking was too small, so users could not read clearly. Seven students also learned to use Scratch because animations, games, and exercises did not confuse the students when they were learning.

Student 8 can already use the learning media independently. In an interview for the response lift, student number 8 said that the Scratch media was exciting, the language was easy to understand, and the illustrations helped them understand the material. However, this student said letters appeared when the character animation spoke too fast, so they could not read the whole sentence. Student number 8 also said that learning in the classroom uses media.

Research and Development is a process or measure for developing or improving a new product, testing the effectiveness of existing products, and developing and creating new products. (Yuliani & Banjarnahor, 2021). In this study, the ADDIE procedure is used to develop learning media. The ADDIE model consists of five stages: Analysis, Design, Development, Implementation, and Evaluation.

At the stage of analysis it was found that there were media constraints when conducting mathematical learning for students and the problem that students had with cartesian coordinate material was that some students could not draw cartesian coordinates and some students were still confused to determine the point in the cartesian coordinate and also the student mistakenly wrote the quadrant of cartesian coordinates students also had difficulty to pinpoint the position of points in a particular point. It is also based on observations and interviews conducted by researchers at

one of the schools in Bandung City. According to Dewi et al. (2019), learning media can make students better understand lessons and improve students' demands. One that the researchers used was Scratch as a learning medium.

The second stage after the analysis is to design the learning media to be planned. Storyboarding is an alternative to describing complete sentences as a planning tool (Khulsum, 2018). Storyboarding is intended to explain the design of learning materials to be developed. Product specification determination is expected to be part of development activities. As for the product developed, the learning media is Scratch. The media is designed on cartesian coordinate material in the middle class. The media was designed with video, animation, audio, and games.

At the development stage, the researchers validated the Scratch learning media on the cartesian coordinate material. Based on the results of the discussion of the research, the results of validation by the media expert validator and a material expert show that the media used is worthy in various aspects of the assessment. The evaluation given by the teacher on the learning media developed obtained a positive response and media worthy of use. Thus, learning media can help teachers implement the learning process, help learners understand the material, and cultivate interest. After students do learning using learning media Scratch, learners are given five questions. Based on the results of the post-test, out of the total number of students 7, six students are declared successful in learning. The success of this learning refers to classical accuracy calculations. Considering the classic accurate calculations, it can be concluded that the learning method is very effective at 85.7% in improving the ability to understand cartesian coordinate matter.

In the discussion section, the important point must be to fulfill the minimum of five discussions. First, there appears to be a connection between the results obtained and the basic concept. It needs to be emphasized whether there is conformity or contradiction with the results of previous research, better or otherwise. Second, describe the findings from the research results. Third, sharp analysis of research data. Third, an explanation of its relationship to previous concepts or theories. Fourth, there is a critical comparison with another relevant research. Fifth, use

constructive arguments. Sixth, some statements confirm or correct previous findings. Discussion can be presented in sub-chapters.

## 4. CONCLUSION

Scratch learning media on cartesian coordinates can be well designed through the ADDIE stages. Using the ADDIE model succeeded in creating a good game with stages namely analysis (analysis of problems experienced by students and teachers), design (selection of material and making storyboards), Development (developing Scratch media and performing validation), Implementation (testing trials to students), Evaluation (evaluation on media with questionnaire and post-test). Based on the results of the pretests and posts, each student progressed towards understanding the concept after using Scratch media. Therefore, further research is needed on various topics in other learning media planning and the effectiveness of using learning media in the classroom.

## 5. REFERENCES

Awalia, I., Pamungkas, A. S., & Alamsyah, T. P. (2019). Pengembangan media pembelajaran animasi powtoon pada mata pelajaran matematika di kelas IV SD. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *10*(1), 49–56.

Chasannudin, A., Nuraini, L., & Luthfiya, N. A. (2022). Pelatihan aplikasi scratch untuk meningkatkan kemampuan computational thinking pada guru. *Jurnal Pengabdian Masyarakat*, *1*.

Dewi, P. S., & Septa, H. W. (2019). Peningkatan kemampuan pemecahan masalah dan disposisi matematis siswa dengan pembelajaran berbasis masalah. *Mathema: jurnal pendidikan matematika*, *1*(1), 31-39.

Dewi, R. K., Wardani, S., Wijayati, N., & Sumarni, W. (2019). Demand of ICT-based chemistry learning media in the disruptive era. *International Journal of Evaluation and Research in Education*, *8*(2), 265-270.

Emanuela, O., & Sudihartinih, E. (2023). Desain multimedia berbasis android pada topik koordinat kartesius menggunakan aplikasi scratch. *Jurnal Pendidikan Matematika Universitas Lampung*, *11*, 119–131.

Fitriatien, S. R. (2019). Analisis kesalahan dalam menyelesaikan soal cerita matematika berdasarkan newman. *Jurnal Ilmiah Pendidikan Matematika*, *4*(1).

Fitriyah, I. M., Pristiwati, L. E., Sa'adah, R. Q., Nikmarocha, N., & Yanti, A. W. (2020). Analisis kesalahan siswa dalam menyelesaikan soal cerita koordinat cartesius menurut teori kastolan. *Al-Khwarizmi: Jurnal Pendidikan Matematika dan Ilmu Pengetahuan Alam*, *8*(2), 109–122.

Ghufron, S., Hartatik, S., Mariati, P., & Ruliansyah, A. (2022). Pelatihan dan pendampingan guru sekolah dasar dalam pembuatan media interaktif berbasis digital aplikasi scratch. *Indonesia Berdaya*, *4*, 19–28.

Intana, N. M., Akhlis, I., & Hardyanto, W. (2018). Pengembangan multimedia pembelajaran fisika berbasis scratch pada pokok bahasan hukum oersted. *UPEJ Unnes Physics Education Journal*, *7*(2), 1-8.

Khulsum, U., Hudiyono, Y., & Sulistyowati, E. D. (2019). Pengembangan bahan ajar menulis cerpen dengan media storyboard pada siswa kelas X SMA. *Diglosia: Jurnal Kajian Bahasa, Sastra, Dan Pengajarannya*, *1*(1), 1-12.

Kustiati, T. (2022). Pengembangan multimedia interaktif sebagai media pembelajaran IPA. Wiyata Dharma: *Jurnal Penelitian Dan Evaluasi Pendidikan*, *10*(1), 81–92.

Lango, J., & Lede, Y. K. (2022). Analisis kesalahan dalam menyelesaikan soal pada materi koordinat kartesius siswa kelas VIII SMP Kristen Karuni. *Jurnal Edukasi Sumba.*

Latip, A. (2022). Penerapan model ADDIE dalam pengembangan multimedia pembelajaran berbasis literasi sains. *DIKSAINS : Jurnal Ilmiah Pendidikan Sains*, *2*(2), 102–108.

Maharani, M., Supriadi, N., & Widiyastuti, R. (2018). Media pembelajaran matematika berbasis kartun untuk menurunkan kecemasan siswa. *Desimal: Jurnal Matematika*, *1*(1), 101-106.

Mayasari, D., & Habeahan, N. L. S. (2021). Analisis kemampuan pemahaman konsep siswa dalam menyelesaikan soal cerita matematika. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(1), 252-261.

Muharni, L. P. J., Roza, Y., & Maimunah, M. (2021). Pengembangan bahan ajar berbasis TIK menggunakan peta wilayah untuk menfasilitasi kemampuan pemahaman konsep matematis siswa. *Jurnal Cendekia*, *5*(1), 148-163.

Muharram, M. R. W., & Fajrin, B. S. (2021). Desain game edukasi sifat-sifat bangun datar segiempat menggunakan aplikasi scratch. *Attadib: Journal of Elementary Education*, *5*(2), 140-149.

Novita, G., & Rachmatin, D. (2021). Desain media pembelajaran matematika topik luas daerah segitiga menggunakan aplikasi scratch. *Jurnal Cendekia:Jurnal Pendidikan Matematika*.

Poobalan, N., Zaharudin, R., & Ting Voon, Y. (2019). Penggunaan bahan multimedia interaktif 3D animasi ('scratch') dalam kaedah pembelajaran teradun terhadap minat dan pencapaian murid tahun 5 bagi mata pelajaran sains. *Jurnal Pendidikan Sains dan Matematik Malaysia*, *9*(1), 49–56.

Setiyowati, N., Kurniadi, E., Suganda, V. A., & Harini, B. (2023). Kemampuan pemecahan masalah siswa kelas VIII pada materi koordinat kartesius dengan pembelajaran pemodelan matematika berbantuan komik pembelajaran. *Teorema: Teori Dan Riset Matematika*, *8*(1), 53.

Sudihartinih, E., Wilujeng, S., & Rachmatin, D. (2021). Desain media pembelajaran matematika topik faktor persekutuan terbesar (FPB) berbasis aplikasi sratch. *Jurnal Pendidikan Matematika Universitas Lampung*, *9*(4), 456–466.

Suseno, P. U., Ismail, Y., & Ismail, S. (2020). Pengembangan media pembelajaran matematika video interaktif berbasis multimedia. *Jambura Journal of Mathematics Education*, *1*(2), 59–74.

Sutikno, S., Susilo, S., & Hardiyanto, W. (2019). Pelatihan pemanfaatan scratch sebagai media pembelajaran. *Rekayasa: Jurnal Penerapan Teknologi Dan Pembelajaran*, *16*(2), 173-178.

Ulfah, T. A., Wahyuni, E. A., & Nurtamam, M. E. (2021). Pengembangan media pembelajaran permainan kartu uno pada pembelajaran matematika materi satuan panjang. Prosiding Seminar Nasional Matematika dan Pembelajarannya Jurusan Matematika FMIPA UM, 955-961.

Yuliani, W., & Banjarnahor, N. (2021). Metode penelitian pengembangan (rnd) dalam bimbingan dan konseling. *Quanta: Jurnal Kajian Bimbingan Dan Konseling Dalam Pendidikan*, *5*(3), 111–118.

Yulianisa, A., & Sudihartinih, E. (2022). Pengembangan Media Pembelajaran Matematika materi perkalian aljabar berbasis aplikasi scratch. *Jurnal Pendidikan Matematika Universitas Lampung*, *10*(2), 142–156.