P-ISSN 2527-5615
E-ISSN 2527-5607

Kalamatika: Jurnal Pendidikan Matematika
Volume 10, No. 1, April 2025, pages 1-14

DEVELOPING A CREATIVE THINKING COMIC FOR LEARNING GEOMETRY

Rizki Dwi Siswanto[1], Yaya Sukjaya Kusumah[2], Dadan Dasari[3], Dadang Juandi[3]

[1]Univeritas Pendidikan Indonesia, Jl. Dr. Setia Budi, Bandung, Indonesia.
rizkids.mathematics@upi.edu
[2]Univeritas Pendidikan Indonesia, Jl. Dr. Setia Budi, Bandung, Indonesia.
yskusumah@upi.edu
[3]Univeritas Pendidikan Indonesia, Jl. Dr. Setia Budi, Bandung, Indonesia.
dadan.dasari@upi.edu
[4]Univeritas Pendidikan Indonesia, Jl. Dr. Setia Budi, Bandung, Indonesia.
dadang.juandi@upi.edu

ABSTRACT

This study explores the development of a creative thinking comic on flat-sided geometric solids as a learning medium for 8th grade students. The comic was developed using the 4D model, which consists of the stages: Define, Design, Develop, and Disseminate. However, only the Define, Design, and Develop stages were carried out in the creation process of this creative thinking comic. In the Define stage, development needs were identified by analyzing student characteristics, reviewing the curriculum, and determining learning outcome indicators. The Design stage involved creating the initial prototype of the comic, including storyline development, visual design, and interactive elements. The comic features content related to flat-sided geometric solids presented through stories connected to students' daily lives, along with practice questions aimed at fostering creative thinking skills. During the Develop stage, experts validated the comic and its supporting instruments, assessing validity, practicality, and effectiveness. Revisions led to the final version of the creative thinking comic. Expert reviews confirmed its suitability, and teacher and student feedback were highly positive, with scores in the "very good" category. Student achievement results showed an average score of 14.48, classified as high.

ARTICLE INFORMATION

Keywords

Creative thinking
Comic
Geometry learning
Visualization

Article History

Submitted *Jan 1, 2025*
Revised *Mar 13, 2025*
Accepted *Mar 15, 2025*

Corresponding Author

Dadan Dasari
Universitas Pendidikan Indonesia
Jl. Dr. Setia Budi, Bandung, Indonesia
Email: dadan.dasari@upi.edu

How to Cite

Siswanto, R. D., Kusumah, Y. S., Dasari, D., & Juandi, D. (2025). Developing a Creative Thinking Comic for Learning Geometry. *Kalamatika: Jurnal Pendidikan Matematika*, *10*(1), 1-14.

https://doi.org/10.22236/KALAMATIKA.vol10no1.2025pp1-14

INTRODUCTION

Geometry is generally perceived as difficult by students because it is abstract and requires strong visualization skills. Many students struggle to grasp geometric concepts related to space, shapes, and the relationships between elements (Fritz et al., 2019; İbili et al., 2020). Limited visualization abilities often lead to poor learning outcomes in geometry. However, learning geometry is essential not only for enhancing spatial visualization but also for developing 21st-century skills (Siswanto et al., 2024) communication, collaboration, critical thinking, problem-solving, creativity (Annisa & Siswanto, 2021; Maryanto & Siswanto, 2021), and technology proficiency (Siswanto et al., 2019).

To improve students' visualization, knowledge, and creativity in geometry, more engaging, interactive, and innovative learning strategies are needed. According Clements & Sarama (2020), contemporary geometry instruction tends to focus on memorization and procedural problem-solving, without incorporating activities that support students' visualization and creativity. This lack of meaningful engagement may hinder the development of their creative thinking abilities. Another contributing factor is students' confusion when encountering problems that differ from the examples previously given by the teacher (Suprapti, 2019). Mathematics instruction continues to emphasize procedural problem-solving that assesses students' memory and focuses on finding a single correct answer, thereby limiting students' thinking skills to mere recall (Maryanto & Siswanto, 2021).

Creative thinking abilities are essential in learning geometry, as they enable students to find innovative solutions, understand conceptual relationships, and develop visual representations. Siswanto (2016) found a very strong correlation between spatial geometry skills (visualization) and students' creative thinking abilities. Therefore, to enhance students' visualization, understanding, and creativity in geometry, innovative and interactive learning media are necessary. One promising medium is the use of creative thinking comics (Cahyono et al., 2023). Comics are widely popular among students as visual learning tools (Widodo, 2017). The use of illustrations and engaging storylines can help simplify complex concepts, making them easier and more enjoyable for students to understand (Fitria, 2023; Yau, 2024). Beyond serving as instructional tools, comics can also stimulate and foster the development of students' creative thinking skills.

According to Guilford (1956, 1957, 1961), creative thinking skills include: 1) fluency or the ability to generate many ideas in response to a problem or for planning solutions to complex issues (Siswanto, 2016). This is considered one of the strongest indicators of creative thinking, as a greater number of ideas increases the likelihood of producing a significant one; 2) flexibility, which refers to the ability to produce diverse approaches to solving problems (Munandar, 2020); 3) elaboration, or the ability to expand upon an idea by breaking it down into more detailed components (Siswanto, 2015); and 4) originality, which is defined as the ability to produce unique or uncommon ideas that are rarely expressed by others, or to solve problems in novel ways (Siswanto & Ratiningsih, 2020). In the context of geometry learning, these four aspects of creative thinking are crucial for helping students visualize, interpret, and solve geometric problems effectively.

Within the curriculum framework, Indonesia has consistently emphasized the integration of Information and Communication Technology (ICT) literacy across all learning topics (Hilda & Siswanto, 2021; Sagita et al., 2019; Siswanto et al., 2024). The *Merdeka Curriculum* (Indonesia's latest education curriculum) also promotes creativity and independent learning. Therefore, the development of creative thinking comics as a learning medium is a strategic step toward more effective, enjoyable, and meaningful instruction.

Comics have the unique potential to present characters, narratives, and contexts that are closely tied to real-life situations, enabling students to connect geometric concepts with everyday experiences. They function not only as a medium for delivering information but also as a tool to stimulate imagination and foster creativity through the visualization of complex geometric ideas (Ziatdinov & Valles Jr, 2022). Comics designed to enhance creative thinking are expected to not only support students in mastering geometry but also to cultivate creative, innovative, and adaptive mindsets aligned with the demands of 21st-century learning.

The development of this creative thinking comic aims to explore the integration of creative thinking skills into comic-based learning media that features flat-sided spatial geometry content within the context of students' daily lives. This study also seeks to evaluate the effectiveness of the comic in the learning process. By understanding how this comic can function as an effective learning medium, the study is expected to provide practical recommendations for educational implementation.

The significance of this research lies in its contribution to the development of more

innovative and contextually relevant teaching media in mathematics. By embedding creative thinking skills into comic-based learning, it is expected that students will not only gain a deeper understanding of mathematical concepts but also enhance their creative thinking—an essential competency in today's rapidly changing world. Additionally, this research is expected to serve as a foundation for further studies in mathematics education and the integration of technology in learning.

Several previous studies have highlighted the use of comic-based visual media in mathematics learning to improve students' visualization, comprehension, and problem-solving abilities. For instance, Mamolo (2022) demonstrated that interactive, comic-based mobile applications enhanced students' evaluation and learning experiences through an innovative approach. However, the study primarily focused on the visual and narrative aspects of comics without incorporating the development of mathematical thinking skills. Meanwhile, research by Pardimin & Widodo (2016) showed improvements in students' geometry problem-solving abilities through structured, problem-solving-based comics. However, this study did not specifically investigate the development of creative thinking skills through such media.

These findings indicate a gap in understanding how comics can be effectively used to foster creative thinking in mathematics learning. While Leikin & Sriraman (2022) emphasize the importance of creativity in mathematics education, they do not specifically explore its application through comic-based media in the context of creative thinking. Therefore, there remains a clear research gap in the integration of creative thinking skills with comic learning media. Although the aforementioned studies highlight the potential of comics to improve mathematics learning, none have comprehensively examined how comics can be utilized to foster creative thinking skills within this domain.

This study offers a novel contribution by developing interactive digital comic media specifically designed to enhance students' mathematical creative thinking skills in geometry. The media integrates visual elements with technology-based interactive approaches, addressing the gap between traditional visual media and modern digital learning tools.

METHOD

This project employs a Research and Development (R&D) approach using the 4D development model, which consists of four phases: Define, Design, Develop, and Disseminate. The 4D model was selected because it provides a systematic framework for

developing comic-based learning media integrated with creative thinking skills. The primary objective of this study is to produce innovative learning media in the form of comics that can enhance students' mathematical creativity in geometry topics. The testing process utilizes both quantitative and qualitative methods to evaluate the effectiveness of the developed media.

Research Stages

The research follows the 4D model, which includes four main stages: Define, Design, Develop, and Disseminate. Each stage is outlined in Table 1.

Table 1. R&D Project Implementation Steps Based on the 4D Model

Stage	Activity Description	Expected Results
Define	1. Conduct needs analysis through interviews with teachers and students. 2. Analyze the curriculum to ensure alignment with learning objectives. 3. Conduct a literature review on mathematical creativity and comic-based media.	Identification of learning needs, relevant content, and the potential for integrating creative thinking skills into comic media.
Design	1. Design the content of the creative thinking comics, including storylines, visuals, and interactive elements. 2. Create contextual problem-based stories relevant to students' daily lives, along with practice questions to enhance creative thinking skills. 3. Develop evaluation instruments such as mathematical creative thinking ability tests, product assessment rubrics, and teacher and student satisfaction questionnaires.	Initial drafts of creative thinking comic media and evaluation instruments, ready for development.
Development	1. Develop a prototype of creative thinking comic based on the design. 2. Conduct expert validation of the media, focusing on: (1) content appropriateness, (2) legal and curricular alignment, (3) presentation, and (4) language (Lisnani et al., 2023; Widodo, 2020) 3. Media reviewed by 8 experts in comics, geometry, and education. 4. Conduct expert validation of the instruments, focusing on: (a) clarity of instructions, (b) format, (c) content and coverage, and (d) language and writing (Pardimin & Widodo, 2016; Widodo et al., 2021). 5. Instruments reviewed by 3 mathematics education experts and 3 junior high school mathematics teachers. 6. Validate media and instruments using Aiken's V formula (1980, 1999) 7. Revise based on expert feedback to improve quality. 8. Conduct development testing through a limited trial involving a small group of students (n = 31) using a one-shot case study design to identify technical (practicality) and pedagogical (effectiveness) issues. 9. Collect data through mathematical creative thinking tests, teacher (n = 4) and student (n = 31) satisfaction questionnaires, and classroom observations.	1. Validated and revised prototypes of creative thinking comic media and instruments. 2. Limited trial data to evaluate the effectiveness and practicality of the comic media.

Data Collection

This study employs both quantitative and qualitative approaches to evaluate the effectiveness of the creative thinking comic media. The approaches, instruments, and data analysis methods are summarized in Table 2.

Table 2. Testing Approaches and Data Collection

Approach	Objective	Instrument	Data Analysis
Quantitative	To measure the effectiveness of the media in improving students' mathematical creativity.	1. Mathematical creative thinking ability test: measures students' fluency, flexibility, originality, and elaboration in solving mathematical problems. 2. The product assessment form consists of 20 open-ended items to evaluate the validity of the product. 3. Teacher and student response/satisfaction form containing 15 closed-ended items to assess	Quantitative data were analyzed using descriptive statistics to assess the level of creative thinking skills after using the media.

		satisfaction with the creative thinking comic media.	
Qualitative	To explore students' and teachers' experiences in using creative thinking comic media.	Interviews: conducted with students and teachers to gain insight into teachers' understanding of using comics in mathematics learning and students' learning difficulties.	Interview data were analyzed thematically to identify key experiences and perceptions related to the comic media.

Research Subjects

The research subjects consisted of students from a junior high school in Jakarta, selected through purposive sampling. The study used an experimental method with a One-Shot Case Study design, which does not include a control group but involves only one group of students who received a special intervention—learning through creative thinking comic media over a certain period.

RESULT AND DISCUSSION

This research produces creative thinking comics for mathematics, particularly focusing on flat-sided space building materials for 8th-grade junior high school students. The goal of developing these creative thinking comics is to help students think creatively while studying mathematics, making it easier and more effective for them to understand flat-sided space construction materials, as opposed to using traditional teacher-prepared school textbooks.

The results of the validation of the creative thinking comics were assessed in terms of content validity and construct validity, using the Aiken formula (1980, 1999). Content validity ensures that teaching materials are scientifically valid and accurate, as emphasized by Pardimin & Widodo (2016). The indicators for validating the creative thinking comics are: (A) comic content feasibility, (B) legal feasibility, (C) presentation quality, and (D) linguistic aspects. Data analysis from the validators used a descriptive approach to assess the feasibility of the creative thinking comics, with scores ranging from 1 to 10 for each indicator, along with suggestions and comments.

For instrument validation, the indicators include: (a) instructions, (b) instrument format, (c) content and coverage, and (d) language and writing. Data analysis from the validators used a descriptive approach to assess the feasibility with a score ranging from 1 to 4 for each indicator, along with suggestions and comments. The data from the feasibility assessments for the creative thinking comics and the instrument, provided by 8 validators and 6 validators, are shown in Table 3.

Table 3. Validation Results of the Creative Thinking Comics and Creative Thinking Instruments

Prototype	Number of Validator	Average of V Coefficient	R_{table}	Conclusion
Comic	8	0,8715	0,7067	Valid
Instrument	6	0,8665	0,8114	Valid

The validity of an aspect in a research product (in this study, in the form of a prototype of creative thinking comic media and a prototype of a creative thinking instrument) can be assessed based on the content validity index (V) obtained and compared to the correlation table (R table) for the number of experts (N). If an aspect has a V coefficient greater than the correlation table coefficient, the product is considered valid and can be used. Conversely, if the V coefficient is less than the correlation table coefficient, the product needs to be revised and improved according to the suggestions of the validator.

The correlation table coefficient for the creative thinking comic media prototype, assessed by 8 experts at a significance level of 5%, is 0.7067. Based on the table, the validation results of the creative thinking comic media prototype, calculated using Aiken's V, showed that all aspects of the prototype had a content validation index greater than 0.7067. Furthermore, the correlation table coefficient for the creative thinking instrument prototype, assessed by 6 experts at a significance level of 5%, is 0.8114. According to Table 3, the validation results of the creative thinking instrument prototype, calculated using Aiken's V, showed that all aspects of the prototype had a content validation index greater than 0.8114. Therefore, it can be concluded that both the creative thinking comic media prototype and the creative thinking instrument prototype are valid.

Researchers asked teachers and students to complete a response questionnaire based on the practicality criterion, focusing on teacher activity (teacher response) in managing learning and student activity (student response) in learning with creative thinking comics. The indicators or aspects of teacher and student responses to creative thinking comics include (A) material aspects, (B) enjoyment aspects, (C) assessment aspects, (D) grammatical aspects, and (E) presentation aspects. Figure 1 displays data on the responses of 4 teachers and the average responses of 31 students to the creative thinking comics.

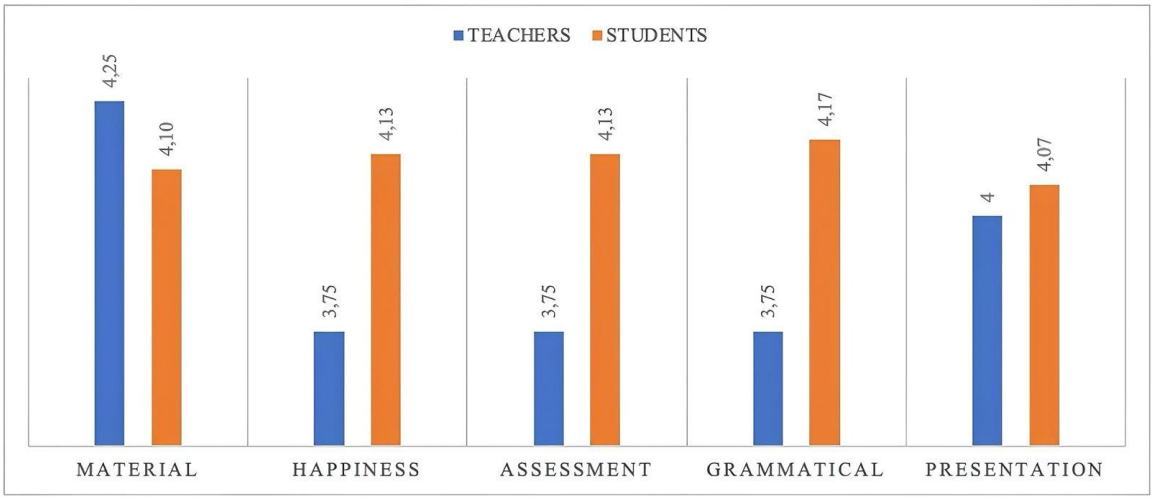

Figure 1. Results of Teacher and Student Responses

The data analysis obtained was in the form of a descriptive assessment of responses to creative thinking comics, with values ranging from 1 to 5. The criteria for the practicality of creative thinking comic products refer to Suswina's (2016) response level criteria, as shown in Table 4.

Table 4. Teacher and Student Response Criteria

Range	Criteria
$3{,}20 < x \leq 5{,}00$	Very Good
$2{,}40 < x \leq 3{,}20$	Good
$1{,}60 < x \leq 2{,}40$	Fair
$0{,}80 < x \leq 1{,}60$	Not Good
$0{,}00 < x \leq 0{,}80$	Very Not Good

All elements or indicators of the teacher and student response questionnaires have an average in the range of $3.20 < x \leq 5.00$, as shown in the table of teacher and student response results to creative thinking comics in Figure 2. In other words, the teacher and student responses to creative thinking comics fall within the "very good" category or criteria. This indicates that creative thinking comics received a very positive response from both teachers and students.

The effectiveness criteria are based on the achievement of students who learned using creative thinking comics on mathematical creative thinking abilities. Using a one-shot case study design as an experimental method, the researcher implemented development testing. This research design involves a group of students who receive special treatment, specifically learning through creative thinking comic media for a period. At the end of the lesson, the subjects completed a test of mathematical creative thinking ability. Table 5 displays data on the achievement of creative thinking skills from 31 students.

Table 5. Achievements of Students' Creative Thinking

Number of Students	X_{min}	X_{max}	$\bar{x}$	*Ds*
31	10	18	14,48	2,23

Ideal Maximum Score: 24

The data on students' creative thinking ability scores, collected during the development testing stage, are then transformed using the normative reference assessment guidelines. The normative reference guidelines are based on ideal creative thinking ability scores, such as the ideal maximum score (24), ideal minimum score (0), ideal average (12), and ideal standard deviation (4). Table 6 displays the normative reference assessment criteria for students' creative thinking abilities.

Table 6. Normative Reference Assessment Criteria for Creative Thinking Abilities

Range	Criteria
$x > 18$	Very High
$14 < x \leq 18$	High
$10 < x \leq 14$	Meduim
$6 < x \leq 10$	Low
$x \leq 6$	Very Low

The average results of students' creative thinking ability achievement, obtained in Table 3, which equals 14.48, are analyzed based on the normative reference assessment criteria defined in Table 6. This falls into the high category. Based on the results of the feasibility test of creative thinking comic products, which include validity, practicality, and effectiveness, it can be concluded that creative thinking comics are feasible and can be used to carry out teaching and learning activities.

The curriculum analyzed and applied to creative thinking comics is the Independent Curriculum (the Education curriculum in Indonesia). The results of the curriculum study produced mathematics learning materials for junior high schools, focusing on geometry and measurement, numbers, and statistics. In the topic of geometry, particularly flat-sided geometric shapes, the emphasis is on finding derivatives of the surface area and volume formulas for these shapes. The tasks given focus more on solving everyday problems related to flat-sided geometric shapes. Therefore, the purpose of learning about flat-sided geometric material in the currently used curriculum is to ensure that students understand the concepts of flat-sided geometric shapes and are able to determine the surface area and volume of these shapes in solving everyday problems.

The flat-sided geometric geometry material chosen by the researcher to create creative thinking comics, it includes (1) elements of flat-sided geometric shapes, (2) nets of flat-sided

geometric shapes, (3) surface area of flat-sided geometric shapes, and (4) volume of flat-sided geometric shapes. Furthermore, the researcher uses and combines the basic competencies from both curricula and indicators of learning achievement based on core competencies.

At the design stage, we, as designers, create creative thinking comics and creative thinking instruments to meet students' needs based on the completed curriculum analysis, topic content, and learning objectives. The comics are equipped with content that includes story material on flat-sided geometric shapes in students' daily lives and practice questions to train creative thinking skills. After the creative thinking comic design was completed, this product was named the creative thinking comic prototype and the creative thinking instrument prototype.

The expert assessment process was carried out during the focus group discussion, resulting in a content validation index greater than 0.7067 in all aspects. The average response rate for creative thinking comics among instructors and students is $3.20 < x \leq 5.00$, showing positive feedback. The average accomplishment of students' creative thinking abilities is 14.48, which, according to the normative reference assessment guidelines, is considered high.

CONCLUSION

The process of developing creative thinking comics in mathematics subjects, particularly in flat-sided spatial geometry material, follows three stages: the definition stage, the design stage, and the development stage. In the definition stage, development requirements are determined and defined, such as analyzing student characteristics, analyzing the curriculum, and formulating indicators for achieving learning outcomes. In the design stage, creative thinking comic content is created, including storylines, visuals, and interactive elements. In the development stage, media and instruments are validated by experts, and the product's feasibility is tested, which includes assessing validity, practicality, and effectiveness, followed by revisions to finalize the creative thinking comic product.

Based on the criteria for the feasibility and quality of creative thinking comics, which include validity, practicality, and effectiveness, it can be concluded that creative thinking comics are feasible and can be used to carry out teaching and learning activities. The creative thinking comics developed in this study are limited to mathematics, specifically flat-sided spatial geometry material. Therefore, it is hoped that future researchers will develop comics that cover different materials and levels from those explored in this study.

ACKNOWLEDGMENTS

This paper is part of a project funded by the Indonesian Endowment Fund for Education (LPDP), which is part of the Ministry of Finance, and the Higher Education Financing Center (BPPT), which is part of the Ministry of Education and Culture. The author expresses their deepest appreciation to LPDP and BPPT for their support. The greatest gratitude is also extended to the Indonesian Education Scholarship (BPI), the Indonesian Education University (UPI), and Universitas Muhammadiyah Prof. Dr. Hamka (UHAMKA) for their support as institutions.

REFERENCES

Aiken, L. R. (1980). Content Validity and Reliability of Single Items or Questionnaires. *Educational and Psychological Measurement*, *40*(4), 955–959. https://doi.org/https://doi.org/10.1177/001316448004000419

Aiken, L. R. (1999). *Personality Assessment Methods and Practice*, *3rd rev*. Hogrefe & Huber Publishers.

Annisa, S., & Siswanto, R. D. (2021). Analisis Kemampuan Komunikasi Matematis ditinjau dari Gaya Kognitif dan Gender. *JPPM (Jurnal Penelitian Dan Pembelajaran Matematika)*, *14*(2). https://doi.org/http://dx.doi.org/10.30870/jppm.v14i2.11604

Cahyono, B., Rohman, A. A., Dzakiyyah, R. I., & Setyawati, R. D. (2023). Pengembangan Media Pembelajaran E-Komik Berbasis Etnomatematika dan Kemampuan Berpikir Kreatif Pada Materi Geometri MTs. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *12*(2), 2283–2295. https://doi.org/: https://doi.org/10.24127/ajpm.v12i2.7398

Clements, D. H., & Sarama, J. (2020). *Learning and teaching early math: The learning trajectories approach*. Routledge. https://doi.org/https://doi.org/10.4324/9781003083528

Fitria, T. N. (2023). Augmented reality (AR) and virtual reality (VR) technology in education: Media of teaching and learning: A review. *International Journal of Computer and Information System (IJCIS)*, *4*(1), 14–25.

https://doi.org/https://doi.org/10.29040/ijcis.v4i1.102

Fritz, A., Haase, V. G., & Rasanen, P. (2019). International handbook of mathematical learning difficulties. In *Cham, Switzerland: Springer* (p. 843). Springer. https://doi.org/https://doi.org/10.1007/978-3-319-97148-3

Guilford, J. P. (1956). The structure of intellect. *Psychological Bulletin*, *53*(4), 267. https://doi.org/https://doi.org/10.1037/h0040755

Guilford, J. P. (1957). Creative abilities in the arts. *Psychological Review*, *64*(2), 110. https://doi.org/https://doi.org/10.1037/h0048280

Guilford, J. P. (1961). Three Faces of Intellect. *Studies in Individual Differences: The Search for Intelligence*, 756–774. https://doi.org/https://doi.org/10.1037/11491-066

Hilda, A. M., & Siswanto, R. D. (2021). Android Application Development : Permutation of the Same Elements Based on Realistic Mathematics Education. *Mathematics Teaching Research Journal*, *13*(4), 170–180.

İbili, E., Çat, M., Resnyansky, D., Şahin, S., & Billinghurst, M. (2020). An assessment of geometry teaching supported with augmented reality teaching materials to enhance students' 3D geometry thinking skills. *International Journal of Mathematical Education in Science and Technology*, *51*(2), 224–246. https://doi.org/https://doi.org/10.1080/0020739X.2019.1583382

Leikin, R., & Sriraman, B. (2022). Empirical research on creativity in mathematics (education): From the wastelands of psychology to the current state of the art. *ZDM–Mathematics Education*, *54*(1), 1–17. https://doi.org/https://doi.org/10.1007/s11858-022-01340-y

Lisnani, L., Putri, R. I. I., Zulkardi, Z., & Somakim, S. (2023). Web-Based Realistic Mathematics Learning Environment for 21st-Century Skills in Primary School Students. *Journal on Mathematics Education*, *14*(2), 253–274. https://doi.org/http://doi.org/10.22342/jme.v14i2.pp253-274

Mamolo, L. A. (2022). Students' evaluation and learning experience on the utilization of Digital Interactive Math Comics (DIMaC) mobile app. *Advances in Mobile Learning Educational Research*, *2*(2), 375–388. https://doi.org/10.25082/AMLER.2022.02.006

Maryanto, N. R., & Siswanto, R. D. (2021). Analisis Kemampuan Berpikir Kritis Matematis Ditinjau Dari Gaya Kognitif Implusif Dan Reflektif. *ANARGYA: Jurnal Ilmiah Pendidikan Matematika*, *4*(1), 109–118. https://doi.org/10.21043/jpm.v2i1.6341

Munandar, U. (2020). *Mengembangkan bakat dan kreativitas anak sekolah*. Jakarta: PT Gramedia.

Pardimin, P., & Widodo, S. A. (2016). Increasing skills of student in junior high school to problem solving in geometry with guided. *Journal of Education and Learning (EduLearn)*, *10*(4), 390–395. https://doi.org/https://doi.org/10.11591/edulearn.v10i4.3929

Sagita, D. D., Asni, A., Nofriza, F., Fitniwilis, F., Burhendi, F. C. A., & Siswanto, R. D. (2019). Students' Digital Literacy Skill to Solve Learning Problems. *International Journal of Innovation, Creativity Anfd Change*, *5*(6), 112–122. https://www.ijicc.net/images/vol5iss6/5611_Sagita_2019_E_R.pdf

Siswanto, R. D. (2015). *Penerapan Pembelajaran Inkuiri Terbimbing berbantuan GeoGebra untuk Meningkatkan Kemampuan Geometri Spasial, Berpikir Kreatif Matematis dan Kemandirian Belajar Siswa SMP*. Bandung: Thesis Universitas Pendidikan Indonesia.

Siswanto, R. D. (2016). Asosiasi Antara Kemampuan Geometri Spasial Dengan Kemampuan Berpikir Kreatif Matematis Siswa. *Kalamatika: Jurnal Pendidikan Matematika*, *1*(2), 141–146. https://doi.org/https://doi.org/10.22236/KALAMATIKA.vol1no2.2016pp141-146

Siswanto, R. D., Hilda, A. M., & Azhar, E. (2019). Development Combinatorics Realistic Mathematics Education Application based on the Android Mobile. *International Journal of Innovation, Creativity and Change*, *5*(6), 123–140.

https://www.ijicc.net/images/vol5iss6/5612_Siswanto_2019_E_R.pdf

Siswanto, R. D., Kusumah, Y. S., Dasari, D., Juandi, D., & Taqiyyah, A. (2024). RME Educational Game Based on Android Mobile to Increase Students' Mathematical Understanding Ability. *The Eurasia Proceedings of Educational and Social Sciences*, *35*, 117–126. https://doi.org/https://doi.org/10.55549/epess.806

Siswanto, R. D., & Ratiningsih, R. P. (2020). Korelasi Kemampuan Berpikir Kritis dan Kreatif Matematis dengan Kemampuan Pemecahan Masalah Matematis Materi Bangun Ruang. *ANARGYA: Jurnal Ilmiah Pendidikan Matematika*, *3*(2), 96–103. https://doi.org/https://doi.org/10.24176/anargya.v3i2.5197

Suprapti, E. (2019). Peningkatan Kemampuan Berpikir Kreatif Siswa Melalui Penerapan Pembelajaran Realistic Mathematic Education (RME). *Didaktis: Jurnal Pendidikan Dan Ilmu Pengetahuan*, *19*(3). https://doi.org/https://doi.org/10.30651/didaktis.v19i3.7710

Suswina, M. (2016). Hasil Validitas Pengembangan Bahan Ajar Bergambar Disertai Peta Konsep Untuk Pembelajaran Biologi SMA Semester 1 Kelas XI. *Ta'dib*, *14*(1), 44–51. https://doi.org/http://dx.doi.org/10.31958/jt.v14i1.196

Widodo, S. A. (2017). Development comic based problem solving in geometry. *International Electronic Journal of Mathematics Education*, *12*(3), 233–241. https://doi.org/https://doi.org/10.29333/iejme/611

Widodo, S. A. (2020). *Pengembangan Mathematical Comic Untuk Pencapaian Kemampuan Pemecahan Masalah Matematis Dan Konfirmasi Norma Sosiomatematika*. (Doctoral dissertation, Universitas Pendidikan Indonesia).

Widodo, S. A., Ibrahim, I., Hidayat, W., Maarif, S., & Sulisyowati, F. (2021). Development of mathematical problem solving tests on geometry for junior high school students. *Jurnal Elemen*, *7*(1), 221–231. https://doi.org/10.29408/jel.v7i1.2973

Yau, N. (2024). *Visualize This: The FlowingData Guide To Design, Visualization, And*

Statistics. John Wiley & Sons.

Ziatdinov, R., & Valles Jr, J. R. (2022). Synthesis of Modeling, Visualization, and Programming in GeoGebra as an Effective Approach for Teaching and Learning STEM Topics. *Mathematics*, *10*(3), 398. https://doi.org/https://doi.org/10.3390/math10030398