

Analysis Of Innovative Learning Media For Teaching Fractions: A Case Study On Pre-Service Mathematics Teachers' Creativity

Yuli Bangun Nursanti*, Farida Nurhasanah

Sebelas Maret University

e-mail: yulibangununs@staff.uns.ac.id

Abstract

The ability to think creatively is not only an individual's ability to analyze based on existing information but also collectively be able to produce new and determine alternatives with various ideas. It needs to be developed among pre-service teachers so they can use it to design their lessons. This study aims to analyze the creativity of pre-service mathematics teachers in designing and developing innovative learning media for teaching fractions. The research used a qualitative approach with a descriptive method and was conducted in class with 42 students. The data was collected from their product of learning media and filling questionnaires through Google Classroom. From the result, we can conclude that the development of student's creative thinking abilities through the creation of innovative learning media is involved in the modification of the creative model, where they make the product more attractive and practical through content and how to present the media.

Keywords: innovative learning media, fractions, creativity

How to Cite: Nursanti, Y.B., Nurhasanah, F. (2024). Analysis of Innovative Learning Media for Teaching Fractions: A Case Study on Pre-Service Mathematics Teachers' Creativity. *International Journal on Emerging Mathematics Education*, 8(1), 49-58. <http://dx.doi.org/10.12928/ijeme.v8i1.28455>

INTRODUCTION

In this era of increasingly rapid and widespread globalization, people continue to be required to be able to immediately adjust, one of which is by trying to develop the potential creative thinking abilities in themselves through education to improve the quality and competitiveness of the nation's children. The ability to think creatively should begin to grow in students starting from the school level considering that this ability can create opportunities for students' futures, including to face problems in global competition (Noviyana, 2017; Rashidov, 2020; Ritter et al., 2020). In order not to be left behind by these developments, the country needs human resources who can efficiently follow it using creative ways, including at the university level, namely students.

The ability to think creatively is the ability of individuals to analyze something based on existing information but also together be able to give birth to new concepts that are more perfect and determine alternatives with various ideas that can be used to solve problems (Siregar, et al., 2020; Kardoyo et al., 2020). Creative individuals show themselves as individuals who have high curiosity, rich in ideas, confident, and like complex problems, and challenges (Andiyana, et al., 2018; Dilla, et al., 2018). Munandar (2009) and Evans (1994) explain that mathematical creative thinking can be measured based on the level of fluency, flexibility, originality, also elaboration (Kartono et al., 2020).

Table 1. Creative Thinking Behavior

| No | Indicators of Creative Thinking | The Description of Indicators of Creative Thinking |
|----|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Fluency | Generate numerous pertinent ideas and responses while maintaining a seamless flow of thought |
| 2 | Flexibility | Produce a diverse range of ideas, demonstrate adaptability in changing methods or approaches, and explore various directions of thought |
| 3 | Originality | Provide uncommon responses that diverge from the norm and are infrequently offered by the majority of individuals |
| 4 | Elaboration | Expand, incorporate, and enhance ideas, and delve into specifics |

Of the many ways that can be used to improve individual creative thinking skills, mathematics is one of the sciences that can train logical, critical, and creative thinking skills (Mufidah, et al., 2013; Zaenuri et al., 2019; Creswell&Speelman, 2020). Mathematical concepts are built through a series of thinking processes with logic as the basis (Mujib, 2018; Nisa et al., 2021; Novaliyosi et al., 2019).

Teachers are not encouraged to provide mathematical concepts in finished form as information that must be memorized by students, but as much as possible teachers should be able to facilitate students to build concepts of mathematics through a series of activities that trigger the emergence of active and independent thinking processes (Ulandari, et al., 2019). To prepare teachers who can build students' thinking processes, prospective teachers need to gain experience in creative thinking during the lecture process. This experience can be obtained by students in mathematics courses and educational courses designed so that students can think creatively in solving various problems.

One of the courses that can provide opportunities for students to solve problems creatively is the innovative mathematics learning course. In this course, prospective mathematics teacher students are expected to bring innovation in mathematics learning through various ways, one of which is by designing learning media. Learning media is suspected to be one of the factors that determine the success rate of the learning process (Nurhayati & Rahardi, 2021; Puspitarini&Hanif, 2019; Ratnasari&Haryanto, 2019). Making mathematics learning media also requires high creativity because it is related to the process of creating designs and programs (Abidin, et al., 2018). The provision of appropriate learning media can make a positive contribution and optimal and maximum results to the ability of students to understand the material learned (Sundayana, 2013).

Relate to the innovative mathematics learning media, the following table presents the ability to think creatively developing innovative mathematics learning media developed from the context of general creativity that has been adjusted (Nurhayati & Rahardi, 2021).

Table 2. Indicators of Creative Thinking Ability in the Development of Innovative Mathematics Learning Media

| No | Creative Model | General Creativity |
|----|----------------|---------------------------------------|
| 1 | Imitative | Imitating a product of the same shape |

| | | |
|---|-------------------|-------------------------------------------------------------------------------------|
| 2 | Modificative | Change the shape of a product so that it becomes more attractive and more practical |
| 3 | Combinative | Combining the functions and forms of several products in a new product. |
| 4 | Creative Extended | Create new works that are interesting and more practical |

Learning media is an educational facility that can be used to optimize teaching and learning activities, as well as foster student learning motivation, and everything that is used, both objects and the environment around students, can be used for the learning process (Moto, 2019). The ability to design and use learning media can be related to Technology Pedagogy Content Knowledge (TPACK) which according to Padmavathi (2017) is a teacher's skills and knowledge to teach using technology effectively (Armiyati & Fachrurozi, 2022).

Through the development of innovative learning media, prospective teachers are expected to utilize and apply technology in line with pedagogical concepts to teach concepts math better. Through this activity, not only do students' creative thinking skills develop, but indirectly students can also grow TPACK during the lecture process (Armiyati & Fachrurozi, 2022). This study aims to analyze the creativity of pre-service mathematics teachers in designing and developing innovative learning media for teaching fractions.

RESEARCH METHOD

The research approach used is a qualitative approach with the method used being descriptive. descriptive research is research conducted to determine the existence of independent variable values, either one or more variables (independent) without making comparisons or relating them with other variables (Sugiyono, 2019). Drawing and analysis are the development of innovative mathematics learning media through creative thinking skills.

The research was conducted on students in the third semester of mathematics education who took the Innovative Mathematics Learning course, code 2083142040 semester V of the 2021 curriculum of the Faculty of Teacher Training and Education, the Mathematics Education Study Program at Sebelas Maret University Surakarta for the 2022/2023 academic year. The subjects of this study were class D students consisting of 42 students with details of 6 sons and 36 daughters.



Data collection of research results is carried out through (1) assessment of the development of innovative mathematics learning media, where assessments related to the design of innovative mathematics learning media are made by referring to indicators of students' creative thinking abilities, and (2) interview results if there are questions you want to ask. Data collection techniques are the dissemination of instruments through Google Classroom and project-based group assignments in developing innovative mathematics learning media. The analysis technique uses indicators of creative thinking skills and data from the collection of product results assessments and interviews if needed.

RESULTS AND DISCUSSION

The development of innovative mathematics learning media through creative thinking by 42 students was carried out in 7 groups, where each group consisted of 6 students.

The results of the presentation of the development of innovative mathematics learning media can be seen in the following table:

Table 3. Material Topics for Innovative Mathematics Learning Media Design

| Group | Material | Class and Media Name | Media Objectives | Media Functions | Documentation |
|-------|------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| 1. | Fractional | Grades 2-3 JOINT VENTURE | 1) Help students understand the concept of fractions 2) Provide a different and varied experience 3) Creating an interactive, creative, fun learning atmosphere, fostering attitudes and skills about educational technology. | 1) To clarify the concept of fractions 2) So that students do not get bored with the lesson 3) So that students can explore understanding of fractions 4) Train students' psychic and motor skills |  <p>Figure 1. Learning Media "PATUNGAN"</p> |
| 2. | Fractional | Grade 5 MARINE | 1) Make it easier for elementary school students to learn fractional material 2) Fostering the motivation of elementary students to learn mathematics using creative and educational | 1) So that students can easily learn mathematics and increase their motivation 2) To be able to engage in active learning |  <p>Figure 2. Learning Media "BAHARI"</p> |

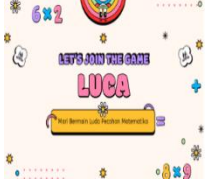

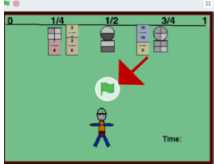
| | | | | |
|----|------------|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3. | Scale | Grade 5 Underwater Adventure | <p>learning methods</p> <p>1) To make it easier for grade 5 elementary students to understand the concept of scale material</p> <p>2) Increase teacher creativity and process and present scale material</p> <p>3) Make it easier for teachers to deliver material</p> | <p>1) To increase students' interest and attention to the scale material</p> <p>2) Help students get a real picture of the implementation of scale material on the map</p> |
| 4. | Fractional | Grade 5 POPOCA | <p>1) Provide breakthroughs and support for Educational Technology activities</p> <p>2) Develop student creativity regarding the development of unique and interesting learning media</p> <p>3) Increase student interest in learning through these media</p> | <p>1) So that students are more willing to learn fractions by providing stimulus in the form of game media</p> <p>2) So that students do not feel happy in learning because this learning media is in the form of games and looks attractive</p> |



Figure 3. Learning Media "Underwater Adventure".



Figure 4. Learning Media "POPOCA"

| | | | | | | |
|----|-------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| 5. | Fractional LUCA | Grade 5 | <ol style="list-style-type: none"> 1) Motivate to learn for students 2) Provide a variety of safe learning experiences 3) Train cooperation between students in solving problems 4) Cultivate competitive attitudes and skills 5) Cultivate an attitude of responsibility | <ol style="list-style-type: none"> 1) To find out whether students still remember the material and the extent to which students understand the material that has been delivered 2) To foster the cognitive development of children |  | Figure 5. Learning Media "LUCA" |
| 6. | Fractional Si Prada Board | Grade 2 | <ol style="list-style-type: none"> 1) Provide stimulus on emotional, intellectual, and psychomotor aspects in students 2) Ripening fractional matter worth | <ol style="list-style-type: none"> 1) To make students more interactive so that learning is more fun 2) So that students develop self-competence, including in the field of technology |  | Figure 6. Learning Media "Papan Si Prada" |
| | Fractional 2D fraction Explore game | Grade 5 | | |  | Figure 7. Learning Media "2D Fraction Explore Game" |

CONCLUSION

Provide a statement that what is expected, as stated in the "Introduction" chapter can ultimately result in "Results and Discussion" chapter, so there is compatibility (Ahmad & Hooper, 2007). Moreover, it can also be added the prospect of the development of research results and application prospects of further studies into the next (based on results and discussion).

ACKNOWLEDGEMENT

Author could thank anyone for their support to the research, such as funder, participants, etc.

DECLARATION

Author Contribution

All authors contribute in the research process, such as collecting the data, analyzing the data, and writing the manuscript. All authors approved the final manuscript.

Funding Statement

This research did not receive any funding.

Conflict of Interest

Both authors declare that they have no competing interests.

Ethics Declaration

We as authors acknowledge that this work has been written based on ethical research that conforms with the regulations of our institutions and that we have obtained the permission from the relevant institutes when collecting data. We support the International Journal on Emerging Mathematics Education (IJEME) in maintaining high standards of personal conduct, practicing honesty in all our professional practices and endeavors.

REFERENCES

- Abidin, J., Rohaeti, E. E., & Afrilianto, M. (2018). Analisis Kemampuan Berfikir Kreatif Matematis Siswa SMP Kelas VIII Pada Materi Bangun Ruang. *Jurnal Pembelajaran Matematika Inovatif*, Volume 1, Nomor 4, 779-784.
- Ahmadin, H. A. (2005). *Psikologi Perkembangan*. Jakarta: Renika Cipta.
- Andiyana, M. A., Maya, R., & Hidayat, W. (2018). Analisis Kemampuan Berpikir Kreatif Matematis Siswa SMP Pada Materi Bangun Ruang. *Jurnal Pembelajaran Matematika Inovatif*, Volume 1, Nomor 3, 239-248.
- Armandita, P., Wijayanto, E., Rofiatus, L., & Susanti, A. (2017). Analisis Kemampuan Berpikir Kreatif Pembelajaran Fisika Di Kelas XI MIA 3 SMA Negeri 11 Kota Jambi. *Jurnal Penelitian Ilmu Pendidikan*, Volume 10, Nomor 2, 129-135.
- Armiyati, L., & Fachrurozi, M. H. (2022). Technological Pedagogical Content Knowledge (TPACK) Mahasiswa Calon Guru di Tasikmalaya. *JIPSINDO (Jurnal Pendidikan Ilmu Pengetahuan Sosial Indonesia)*, Vol 9, No 2, 164-176.
- Cresswell, C., & Speelman, C. P. (2020). Does mathematics training lead to better logical thinking and reasoning? A cross-sectional assessment from students to

- professors. PLoS ONE, 15(7 July).
<https://doi.org/10.1371/journal.pone.0236153>
- Dilla, S. C., Hidayat, W., & Rohaeti, E. E. (2018). Faktor Gender Dan Resiliensi Dalam Pencapaian Kemampuan Berpikir Kreatif Matematis Siswa SMA. *Journal of Medives*, Volume 2, Nomor 1, 129-136.
- Ekayani, N. L. (2017). Pentingnya Penggunaan Media Pembelajaran Untuk Meningkatkan Prestasi Belajar Siswa. *Jurusan PGSD, Fakultas Ilmu Pendidikan Universitas Pendidikan Ganesha*, 1-11.
- Hidayati, W. S., & Trisanti, L. B. (2023). Creativity Profile of Students in Constructing Mathematics Learning Media. *JTAM (Jurnal Teori Dan Aplikasi Matematika)*, 7(3), 836. <https://doi.org/10.31764/jtam.v7i3.15223>
- Kardoyo, Nurkhin, A., Muhsin, & Pramusinto, H. (2020). Problem-based learning strategy: Its impact on students' critical and creative thinking skills. *European Journal of Educational Research*, 9(3), 1141-1150. <https://doi.org/10.12973/EU-JER.9.3.1141>
- Kartono, A. J., Sukestiyarno, Y. L., & Mariani, S. (2020). The Identification of Students' Mathematical Creative Thinking Ability on Transformation Geometry. *ATLANTIS PRESS: Advances in Social Science, Education, and Humanities Research*, 443, 101-104.
- Khairunnisa, G. F., & Ilmi, Y. I. (2020). Media Pembelajaran Matematika Konkret Versus Digital: Systematic Literature Review di Era Revolusi Industri 4.0. *Jurnal Tadris Matematika*, Vol 3, No 2, 131-140.
- Moto, M. M. (2019). Pengaruh Penggunaan Media Pembelajaran dalam Dunia Pendidikan. *Indonesian Journal of Primary Education*, Volume 3, Nomor 1, 20-28.
- Mufidah, L., Effendi, D., & Purwanti, T. T. (2013). Penerapan Model Pembelajaran Kooperatif Tipe TPS Untuk Meningkatkan Aktivitas Belajar Siswa Pada Pokok Bahasan Matriks. *Jurnal Pendidikan Matematika STKIP PGRI Sidoarjo*, Volume 1, Nomor 1, 117-125.
- Mujib, A. (2018). Konflik Kognitif Dalam Pembelajaran Kalkulus II. *Prosiding Seminar Nasional Hasil Penelitian* (pp. 68-78). Medan: UMN Al-Washliyah Medan.
- Nisa, L. C., Waluya, S. B., Kartono, & Mariani, S. (2021). Developing Mathematical Conceptual Understanding through Problem-Solving: The Role of Abstraction Reflective. *ATLANTIS PRESS: Advances in Social Science, Education, and Humanities Research*, 574.
- Novaliyosi, Tola, B., & Rahayu, W. (2019). TRENDS OF MATHEMATICAL LOGICAL THINKING ABILITY THROUGH THE CRA (CONCRETE-REPRESENTATIONAL-ABSTRACT) APPROACH WITH PORTFOLIO ASSESSMENT. *IJER: Indonesian Journal of Education; Review*, 6(2), 98-112. <http://pps.unj.ac.id/journal/ijer>
- Noviyana, H. (2017). Pengaruh Model Project Based Learning Terhadap Kemampuan Berpikir Kreatif Matematika Siswa. *Jurnal Edumath*, Volume 3, Nomor 2.
- Nurhayati, N., & Rahardi, R. (2021). Kemampuan Berpikir Kreatif Mahasiswa Dalam Mengembangkan Media Pembelajaran Matematika Saat Pandemi Covid-19. *Jurnal Pembelajaran Matematika Inovatif*, Volume 4, Nomor 2, 331-342.
- Primasari, R., Zulfiani, & Herlanti, Y. (2014). Penggunaan Media Pembelajaran di Madrasah Aliah Negeri Se-Jakarta Selatan. *EDUSAINS*, Volume VI, Nomor 01, 68-72.
- Puspitarini, Y. D., & Hanif, M. (2019). Using Learning Media to Increase Learning Motivation in Elementary School. *Anatolian Journal of Education*, 4(2), 53-60. <https://doi.org/10.29333/aje.2019.426a>

- Rahmawati, Zaenuri, Mulyono, & Cahyono, A. N. (2022). Kompetensi Calon Guru Matematika: Kreativitas dalam Membuat Powerpoint pada Praktik Pengalaman Lapangan (PPL). Prosiding Seminar Nasional Pascasarjana (pp. 888-892). Semarang: Pascasarjana Universitas Negeri Semarang.
- Rashidov, A. (2020). DEVELOPMENT OF CREATIVE AND WORKING WITH INFORMATION COMPETENCES OF STUDENTS IN MATHEMATICS. *European Journal of Research and Reflection in Educational Sciences*, 8(3). www.idpublications.org
- Ratnasari, D., & Haryanto. (2019). Analysis of Utilization of Gadgets as Effective Learning Media in Innovation Education to Improve Student Learning Achievement. *Kne Social Sciences*.
- Ritter, S. M., Gu, X., Crijns, M., & Biekens, P. (2020). Fostering students' creative thinking skills by means of a one-year creativity training program. *PLoS ONE*, 15(3). <https://doi.org/10.1371/journal.pone.0229773>
- Salam, R., Akib, H., & Daraba, D. (2018). Utilization of Learning Media in Motivating Student Learning. *ATLANTIS PRESS: Advances in Social Science, Education and Humanities*, 226, 1100-1103.
- Siregar, R. N., Mujib, A., Hasratuddin, & Karnasih, I. (2020). Peningkatan Kemampuan Berpikir Kreatif Siswa Melalui Pendekatan Matematika Realistik. *Edumaspul Jurnal Pendidikan*, Volume 4, Nomor 1, 56-62.
- Sugiyono. (2019). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.
- Sundayana, R. (2013). *Media Pembelajaran Matematika*. Bandung: Alfabeta.
- Supardi. (2015). Peran Berpikir Kreatif Dalam Proses Pembelajaran Matematika. *Jurnal Informatif*, Vol 2, No 3, 248-262.
- Supriyono. (2018). Pentingnya Media Pembelajaran Untuk Meningkatkan Minat Belajar Siswa SD. *Edustream: Jurnal Pendidikan Dasar*, Volume II, Nomor 1, 43-48.
- Tamirino, N. G., Hendriana, H., & Hidayat, W. (2023). Analysis of Mathematical Creative Thinking Abilities of High School Students in West Bandung Regency. *JIML*, 6(2), 104-112. <https://doi.org/10.22460/jiml.v6i2.p15580>
- Thabroni, G. (2022, April 28). Berpikir Kreatif (Creative Thinking) - Pengertian, Indikator, Tahap, dsb. Retrieved from serupa.id: <https://serupa.id/berpikir-kreatif-creative-thinking-pengertian-indikator-tahap-dsb/>
- Ulandari, N., Putri, R., Ningsih, F., & Putra, A. (2019). Efektivitas Model Pembelajaran Inquiry Terhadap Kemampuan Berpikir Kreatif Siswa Pada Materi Teorema Pythagoras. *Journal Cendekia: Jurnal Pendidikan Matematika*, Volume 3, Nomor 2, 227-237.
- Zaenuri, N., & Suhito, P. A. (2019). Mathematical creative thinking ability based on students' characteristics of thinking style through selective problem solving learning model with ethnomatematics nuanced. *Unnes Journal of Mathematics Education*, 8(1), 49-57. <https://doi.org/10.15294/ujme.v8i1.29192>
- Zakiah, N. E., Fatimah, A. T., & Sunaryo, Y. (2020). Implementasi Project-Based Learning Untuk Mengeksplorasi Kreativitas dan Kemampuan Berpikir Kreatif Matematis Mahasiswa. *Teorema: Teori dan Riset Matematika*, Vol 5, No 2, 285-293.

This page is intentionally left blank