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Development of Neuroscience-Based E-module to Improve Mathematical Creative Thinking Skills

Nuranita Adiastuty[1*], Winayu Maulina Pritiya[2], Dilla Dzahrotul Aeni[3]

Mathematics Education, Universitas Kuningan
Cut Nyak Dien Cijoho, Kuningan, West Java, Indonesia
[1*]*nuranita.adiastuti@uniku.ac.id*; [2]*winayupritiya14@gmail.com*; [3]*dilladzh@gmail.com*

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Abstrak

Penelitian ini menangani gap dalam pendidikan matematika yaitu keterbatasan kapasitas siswa dalam pemecahan masalah kreatif. Tujuan kami adalah merancang dan memvalidasi modul pembelajaran digital yang didasarkan pada prinsip-prinsip neurosains, secara khusus menargetkan peningkatan penalaran matematis kreatif di kalangan peserta didik sekolah menengah atas. Kami menggunakan kerangka penelitian pengembangan mengikuti metodologi Plomp, yang mencakup analisis kebutuhan awal, tahap desain berulang, dan prosedur evaluasi produk yang komprehensif. Subjek penelitian adalah siswa kelas XI MIPA 1 di SMA Negeri 3 Kuningan, dengan lima validator ahli yang menilai e-modul tersebut. Penilaian ahli menghasilkan rata-rata penilaian 3,88 untuk kualitas konten dan 3,85 untuk desain multimedia, menunjukkan kesesuaian yang kuat dengan standar pedagogis yang telah ditetapkan. Kepraktisan modul dinilai sangat baik dengan tingkat respon siswa mencapai 90,1%. Peningkatan keterampilan berpikir kreatif diukur melalui pretest-posttest dengan nilai N-Gain sebesar 0,7 (kategori tinggi). Penelitian ini menunjukkan bahwa e-modul yang dikembangkan adalah valid, praktis, dan efektif sebagai solusi pembelajaran kreatif.

***Kata Kunci**: E-Modul; Kemampuan Berpikir Kreatif; Model Plomp; Neurosains.*

Abstract

The study addresses a critical gap in mathematics education: students' limited capacity for creative problem-solving. Our objective was to design and validate a digital learning module grounded in neuroscience principles, specifically targeting the enhancement of creative mathematical reasoning among high school learners. We employed a developmental research framework following Plomp's methodology, encompassing initial needs analysis, iterative design phases, and comprehensive product evaluation procedures. The research subjects were students of class XI MIPA 1 at SMA Negeri 3 Kuningan, with the five expert validators who assessed the e-modul. Expert appraisal yielded mean ratings of 3.88 for content quality and 3.85 for multimedia design, indicating strong alignment with established pedagogical standards. The practicality of the module was rated very good with the student response rate reaching 90,1%. The improvement of creative thinking skilss was measured through pretest-postest with an N-Gain value of 0,7 (high category). This research shows that the developed e-module is valid, practical, and effective as a creative learning solution.

Keywords: E-Module; Creative Thinking Skills; Plomp Model; Neuroscience.

I. INTRODUCTION

As a foundational discipline, mathematics serves as the intellectual infrastructure for technological advancement and scientific inquiry, fundamentally shaping cognitive development across populations (Firdaus 2019). Mathematics as one of the subjects offered in elementary and secondary education should be able to support achieving the national education goals (Fadillah, Subroto, and Praja 2019). Regulation of the Minister of Education and Culture number 36 of 2018 states that Curriculum 2013 goal of preparing the Indonesian people for life as faithful, innovative, active, productive, creative, and active citizens contributes to social, national, national, and global civilization. Moreover, the Regulation of the Minister of National Education Number 14 of 2019 as an advanced form of the free curriculum states that the learning process is designed by students (student-centered) aims to encourage motivation, interest, creativity, initiative, self-reliance, and the free spirit of learning.

The 21st century is now required of a young creative generation, can make the right decision, flexibility, critical thinking, and skillful problem-solving (Sani, 2019; Wahid, 2022). An indispensable skill is 4C, one of which is the ability to think creatively (Gunawan et al., 2022). The creative thinking skills of education are an aspect to be improved and become an important capital for a student to optimize the workings of the brain to develop his thinking (Sani, 2019). Creative thinking skills is a necessary part of mathematics, particularly in resolving mathematical problems (Aripin & Purwasih, 2017; Jagom et al., 2020). In the current society era 5.0, the mathematical creative thinking skills are something that must be expanded because it is part of the abilities that students need in facing the development of science and technology, challenges, demands, and global competition. Creative cognition represents the deliberate capacity to generate novel, unconventional solutions while maintaining precision and logical coherence in problem-solving contexts (Andiyana et al., 2018). Creative thinking skills aim to find and create new ideas that emphasize the aspects of fluency, flexibility, and novelty (Suripah & Retnawati, 2019). The indicator of creative thinking skills refers to the indicators by Silver (Silver, 1997), presented in the following Table 1.

Table 1.
Creative Cognition Assessment Framework

No	Creative Thinking Indicators	Students Abilities
1	Fluency	Students can solve problems with various answers and solutions
2	Flexibility	Students can solve problems in more than one way, from a different point of view
3	Novelty	Students can resolve problems with answers that are unusual or different from other students

Based on the results of observations and preliminary studies in a high school in the Kuningan district obtained that students' mathematical creative thinking skills were still at a low level. The preliminary assessment showed that only 25% of students could solve problems with multiple solutions (fluency indicator), 18% could approach problems from different perspectives (flexibility indicator), and

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merely 12% provided novel or unconventional solutions (novelty indicator), with an average creative thinking score of 38 out of 100. Furthermore, the availability of teaching materials in schools is still limited primarily to math study, where students only used textbooks as a learning resource other than the teacher.

The mathematical creative thinking skills is one of the highest-level thinking abilities that is rated low and is not getting the attention of the teacher (Faturohman & Afriansyah, 2020; Halini et al., 2023; Efwan et al., 2024). International assessments reveal concerning patterns: Indonesian students ranked 74th among 79 nations in PISA 2018 mathematics evaluations, scoring 379 compared to the OECD mean of 487 and was in the low-performance quadrant (OECD, 2018). These results indicate that the level of students' creativity in solving math problems is still low because the problems tested on the PISA test are contextual problems that require creativity, reasoning, and argumentation to solve them (Adiastuty et al., 2020). These results are in line with research which shows that the students' mathematical creative thinking skills at SMKN 2 Pekanbaru are still relatively low because the average percentage of all indicators is 42% (Santi et al., 2019). Based on the results of observations and preliminary studies in a high school in the Kuningan district obtained that students' mathematical creative thinking skills were still at a low level. Furthermore, the availability of teaching materials in schools is still limited primarily to math study, where students only used textbooks as a learning resource other than the teacher. The sequences and series of materials that students learn from the learning resources used have not fully stimulated dan improved students' mathematical creative thinking skills. This is in line with the teacher's statement which states that the learning resources used do not fully facilitate the students to improve their mathematical creative thinking skills.

The effort to learn mathematics in particular encourages students' creative thinking skills on the sequences and series materials that develop the teaching materials used in the learning process. Teaching materials are a set of learning component that is arranged systematically from the competencies to be achieved by students in the learning process (Oktaviana & Prihatin, 2019). Good teaching materials make students able to learn actively, and independently, achieve the expected competencies, and facilitate students' journey to achieve optimal learning results (Ambita et al., 2021; Prayogi et al., 2022). Teaching materials in the form of a module are needed to support and facilitate the learning process (Istikomah & Herlina, 2020).

The development of science and technology encourages the transformation of print technology into digital technology in the presentation of learning (Alpiani et al., 2022). Therefore, the representation of the print module can be converted into an electronic form until the term e-module or electronic module emerges. An e-module is a systematic teaching material based on a curriculum in a given time unit, which is

packed with electronic devices such as a computer or a smartphone (Laili et al., 2019). The e-module used in the student learning process is rated as more effective and can improve student skills, in this discussion which is student mathematical creative thinking skills (Hasanah et al., 2023).

A learning approach that can be used to improve creative thinking skills is the neuroscience approach. This is in line with research that suggests that creative thinking ability is closely linked to the brain's operation (Adiastuty et al., 2020). The activation of the brain's work system can stimulate and embody one's thought creativity (Putri & Ribawati, 2022; Yusmaliana & Suyadi, 2019). The learning process with the neuroscience approach plays a key role in developing the brain's ability to perform various actions or efforts to improve memory, sensitivity, awareness, and achieve the expected ability of creative thinking (Ahmad, 2019; Sirwanti, 2018). Additionally, the principle of the neuroscience approach is to concentrate on brain-friendly learning, with emphasis on conception, music, setting scenes, movement methods, art therapy, active and fun learning, and hypnoteaching (Muhtadi, 2019; Rulyansah et al., 2017; Sumiati & Gumiandari, 2022). The neuroscience stages consist of five stages, there are preparation, acquisition, elaboration, memory formation, and functional integration (Jensen, 2008). The use of an e-module based on neuroscience in the learning process is expected to train the creative thinking skills of high school students grade in XI.

Based on the above description, it will be developed an e-module for sequences and series material based on neuroscience to improve students' mathematical creative thinking skills. The purpose of this study is to develop an e-module that is valid, practical, and creative thinking abilities.

II. METHOD

Our methodological approach follows a developmental research paradigm, specifically adopting Plomp's systematic framework for educational innovation. This methodology emphasizes iterative cycles of design, implementation, and refinement to create evidence-based instructional materials (Sugiyono 2018). The e-module developed through the Plomp model goes through three phases, the preliminary phase, the prototyping phase and the assessment phase (Plomp and Nieveen 2013). The subjects of this study were eleventh-grade students from a high school in Kuningan, Indonesia, namely the class of XI MIPA 1 at SMAN 3 Kuningan, of which there were 36 students.

Some of the instruments in this study are validation questionnaires, e-module practicality questionnaires, and mathematical creative thinking test instruments. Quality assurance instruments were administered to expert panels for comprehensive appraisal of content accuracy, pedagogical soundness, and technical functionality, enabling identification of enhancement opportunities. The two types of validation questionnaires used in this study are media and material validation questionnaires. The e-module practicality questionnaire aims to find out whether the developed e-module

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is included in the practical or very practical criteria. This validation and practicality questionnaires uses differential semantic scales in one line with the criteria of misappropriate and appropriate (Sugiyono, 2018). Then, the creative thinking test instrument is in the form of items given to the test subjects. The goal is to find out the increase in students' mathematical creative thinking skills. The test instrument was adapted to the indicators of creative thinking skills proposed by Silver, namely fluency, flexibility, and novelty (Silver, 1997).

The data obtained during the research will be carried out by the process of data analysis or data processing, to determine the level of validity, practicality of the e-module, and improving the students' mathematical creative thinking skills. The validity test data is obtained from the results of a validation questionnaire which will determine whether the developed e-module is valid or not. Instructional materials met quality thresholds when composite expert ratings across all dimensions achieved minimum acceptable benchmarks as specified in our analytical framework (Maulana, 2017). The e-module validity data is grouped according to the criteria in Table 2.

Table 2.
Expert Validation Rating Scale

Score of Vaidation	Criteria
$\mathbf{3,5 \leq X \leq 4}$	Very Valid
$\mathbf{2,5 \leq X < 3,5}$	Valid
$\mathbf{1,5 \leq X < 2,5}$	Less Valid
$\mathbf{X < 1,5}$	Invalid

Source : (Maulana 2017)

Whereas, practicality test data were obtained from practical instruments given to students after the learning process using an e-module. The results of the practicality test will determine whether the developed e-module is practical or not. E-module teaching materials are said to be practical if the percentage value is in practical or very practical criteria (Irsalina & Dwiningsih, 2018). The practicality value data are grouped according to the criteria contained in Table 3.

Table 3.
User Practicality Evaluation Criteria

Percentage (%)	Criteria
0 – 20	Not practical
21 – 40	Less practical
41 – 60	Quite practical
61 – 80	Very practical
81 – 100	

Source : (Irsalina & Dwiningsih, 2018)

Improving students' mathematical creative thinking skills using the N-Gain data analysis technique. The ability to think creatively is said to have increased if the N-Gain value is in the medium and high criteria (Lestari & Yudhanegara, 2017). N-Gain value data are grouped according to the criteria contained in Table 4.

Table 4.
N-Gain Score Criteria

N-Gain Score	Criteria
N-Gain $\geq \mathbf{0,70}$	High
$\mathbf{0,30} <$ N-Gain $< \mathbf{0,70}$	Medium
N-Gain $\leq \mathbf{0,30}$	Low

Source : (Hake 1999)

This table shows the result of e-module validation based on the assessment of five expert validators, including three mathematics education lectures, one of information systems lecturer, and one mathematics teacher. The average value obtained from this assessment reflects the level of validity of the e-module developed, with the criteria being very valid if the average value is above 3.5.

III. RESULT AND DISCUSSION

A. Result

The development of an e-module for sequences and series material based on neuroscience to improve students' mathematical creative thinking skills using a Plomp development model. Plomp development procedures consist of a preliminary phase, prototype phase, and assessment phase. These three phases are described in detail as follows.

1. Preliminary Phase

Initial diagnostic activities focused on identifying instructional challenges through systematic classroom observations and structured consultations with mathematics faculty at our partner institution SMAN 3 Kuningan. The analyzes carried out to support this development process included problem analysis, curriculum analysis, student analysis, and learning material analysis. Situational analysis revealed exclusive reliance on standardized textbooks as primary instructional resources, with limited incorporation of supplementary or differentiated learning materials to address diverse student needs, without making and developing other learning materials as an e-module. Thus, the teaching materials used have not fully supported and fostered students' mathematical creative thinking skills. Research suggests that e-module are communicative and interactive teaching materials that can make learning easier (Laili et al., 2019). In addition, the use of an e-module in school study can make it easier for a student to improve their creative thinking skills (Hasanah et al., 2023).

Curriculum analysis indicates that the curriculum used in SMAN 3 Kuningan is the curriculum 2013 revision. Furthermore, students' analysis of the information is that students are at a low level of creative thinking skills because the students are not used to solving mathematics problems with creative thinking indicators, students are still focused on the completion methods the teacher exemplified in the learning and completion on the package book. Students are still having trouble resolving problems with an indicator of creative thinking skills in sequences and series material (Syahroni et al., 2021). Analysis of learning material was carried out by reviewing the high school syllabus of Curriculum 2013 shows that one of the materials taught in Compulsory Mathematics in grade XI is sequences and series. This material is one of many that have been tested on tests. This is in line with research which states that it is important for students to understand and be experts in the material of sequences and series because they can build and grow their mathematical creative thinking skills in solving problems (Laela, 2017). Thus, the learning material presented in the e-module is sequences and series material, then reviewed basic competence, indicators of competency achievement, and the objective learning that corresponds with the selected materials.

2. Prototyping Phase

The prototype phase is designing an e-module that are developed and compiling the assessment instruments. The design of the e-module is a concept of the beginning of the lesson materials according to previous analysis. Development utilized a multi-platform approach: initial content authoring in word processing applications,

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conversion to portable document format, and subsequent enhancement through interactive publishing software to generate web-accessible and standalone executable versions, and edited to produce an e-module with exe and HTML formats through websites. The developed an e-module present examples and exercises of related problems adapted to creative thinking indicators. Thus, the use of e-module in learning can help students to understand sequences and series materials, and improve their mathematical creative thinking skills. In addition, there are practice activities and work guidelines to attract students' interest in the learning process.

The e-module components developed in this study consist of cover, e-module profiles, concept maps, introductions, learning activities, student activities, exercise questions, evaluation of learning outcomes, answer keys and discussion, and bibliography (Depdiknas, 2008). Besides that, the e-module procedure developed is adapted to the neuroscience stages presented by Jensen (Jensen, 2008). The neuroscience procedures in the e-module are shown in the table 5.

Table 5.
Content Design of E-Module Based on Neouroscience

Neuroscience Stages	Activities on E-Module
Preparation	Exploration activities through video presentation and introductory narratives
Acquisition	Exposure learning materials and simulations through problem exercises
Elaboration	Feedback given through the learning video
Memory	Video presentation activities for muscle stretching and relaxation
Formation	
Functional Integration	Giving quizzes both in writing and through interactive games-based quizzes

The developed e-module based on neuroscience is equipped with music, pictures or illustrations, learning videos, and materials supporting videos to visualize the material to make students easier to understand. The e-module are also equipped with mini projects, game-based interactive quizzes at the end of learning, brain gym, and body percussion at each learning activity to create learning processes that relax, challenge, delight, and encourage interest in student learning, so that students can be actively and message processing in the brain will be more optimized in various ways, such as solving problems, discovering new ideas, innovation, and creativity in the learning process. This is in accordance with the principles of neuroscience learning which prioritizes brain-friendly learning activities, with emphasis on conception, music, setting scenes, movement methods, art therapy, active and fun learning, and hypnoteaching (Sumiati & Gumiandari, 2022). Figure 1 is the result of the prototyping phase.

Figure 1. Sample Description of E-Module Based on Neuroscience.

3. Assesment Phase

The last stage is the assessment phase. This step is conducted as a test of the validity, practicality, and creative thinking ability tests carried out from the e-module developed for the validators and students. The results of the initial design of the e-module were then assessed by a validator consisting of material and media expert validators. The validation results from material experts are presented in Table 6.

Table 6.
Material Expert Validation Results

Aspects/Indicators	Average Assesment	Criteria
Feasibility of Content	3,81	Very Valid
Language	3,90	Very Valid
Presentation	3,88	Very Valid
Creative Thinking	3,92	Very Valid
Overall Average	3,88	Very Valid

The results of the validation from material experts of the e-module belong to a very valid category, with an average value of 3.88. Then, the results of the validation from media experts of the e-module are included in the very valid criteria, with an average validity value of 3.85. Viewed from all aspects, the developed e-module have met the validity criteria and already be used in the learning process. The results of the validation of the media experts are presented in Table 7 below.

Table 7.
Material Expert Validation Results Media Expert Validation Result

Aspects/Indicators	Average Assesment	Criteria
Display Screen Design	3,60	Very Valid
Ease of Use	4,00	Very Valid
Consistency	4,00	Very Valid
Grafting	3,81	Very Valid
Overall Average	3,85	Very Valid

Following the validation process, the e-module underwent several revisions based on the feedback and suggestions from the expert validators. The material expert validators recommended improving the clarity of mathematical notation in several examples, adding more scaffolding questions in the practice activities to better guide students' creative thinking process, and refining the alignment between learning objectives and assessment items. Meanwhile, the media expert validators suggested enhancing the contrast ratio of text and background colors for better readability, optimizing the file size of embedded videos to ensure smooth loading, and adjusting the navigation buttons placement for more intuitive user interaction. All of these suggestions were carefully considered and implemented in the revised version of the e-module before proceeding to the field trial phase. The revision process ensured that the e-module not only met the validity criteria theoretically but was also practically ready for implementation in the actual learning environment.

Furthermore, a trial of the e-module was carried out with thirty six students of class XI MIPA 1 at SMAN 3 Kuningan. The trial was conducted in March to May 2023 in four meetings. The first meeting carried out a pretest for mathematical creative thinking skills, the second meeting discussed the material for arithmetic sequences and series, and the third meeting discussed the material for geometric sequences and series. Then, in the fourth meeting, students were asked to fill out a response questionnaire that aims to determine the practical value of the e-module that has been used during the learning process in the classroom, and creative thinking tests to find out the

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increase in students' mathematical creative thinking skills. The analysis results of e-module practicality fall into a very practical category, with an average value of practicality being 90.1% of the maximum value of 100%. Viewed from all aspects, the developed an e-module have met the criteria of practicality and already be used in the learning process. The results of e-module practicality are presented in Table 8.

Table 8.
Practicality Results of E-Module

Aspects/Indicators	Average Assesment (%)	Criteria
The attractiveness of the e-module design	91	Very Practical
The e-module is easy to use	85	Very Practical
The use of the e-module for self-study	83	Very Practical
Completeness of the presentation of the material	94	Very Practical
The instructions used are easy to understand and apply	95	Very Practical
Ease of reading text	97	Very Practical
The attractiveness of the color composition of the e-module	86	Very Practical
Ease of understanding the material with the help of pictures and videos	91	Very Practical
The sentences used are easy to understand	89	Very Practical
Overall Average	90,1	Very Practical

The data on increasing the student's mathematical creative thinking skills are acquired after the learning process by giving post-test questions. N-gain analysis shows an increase in the mathematical creative skills of XI MIPA 1 at SMAN 3 Kuningan after being processed using the N-Gain test, obtaining an average value of 0.7 with high improvement criteria. N-gain analysis results are presented in Table 9.

Table 9.
N-Gain Analysis Result

Number of Students	Pretest Average Score	Post-Test Average Score	N-Gain Average Score	Criteria
36	42	80	0,66	Medium

For direct access to the e-module that has been developed, please scan the barcode in figure 2.

Figure 2. QR Code E-Module Web Site Version.

Figure 2. QR Code E-Module Laptop Application Version

This barcode provides direct access to the neuroscience-based e-modules that have been developed. By scanning this barcode, users can download or open the e-module to improve mathematical creative.

B. Discussion

The results demonstrate that the neuroscience-based e-module is valid, practical, and moderately effective in improving students' mathematical creative thinking skills. These findings require

deeper analysis to understand their significance for mathematics education.

1. Validity and Design Quality

Strong expert endorsement (content: 3.88; multimedia: 3.85) demonstrates effective synthesis of instructional theory and brain-compatible design principles within the developed resource. The five neuroscience stages—preparation, acquisition, elaboration, memory formation, and functional integration—provide a systematic framework that mirrors how the brain naturally processes information (Jensen, 2008). Multimodal content delivery—encompassing audiovisual presentations, musical elements, and responsive assessment features—engages diverse cognitive channels, thereby stimulating varied neurological processing routes, enhancing information encoding and creative problem-solving (Rulyansah, Hasanah, and Wardana 2017; Sumiati and Gumiandari 2022). Brain gym exercises and body percussion activities strategically maintain students' attention and arousal levels, which are critical for sustained cognitive engagement (Ahmad 2019).

2. Practicality and User Experience

The very high practicality rating (90.1%) reflects both technical usability and alignment with students' learning preferences as digital natives (Laili, Ganefri, and Usmeldi 2019). The e-module's self-paced learning design and immediate feedback through interactive quizzes empower students to take ownership of their learning—a key factor in developing higher-order thinking skills (Hasanah, Supeno, and Wahyuni 2023). High ratings in "ease of understanding with pictures and videos" (91%) and "completeness of material presentation" (94%) suggest that the multimodal approach effectively scaffolds understanding while balancing cognitive challenge and support (Alpiani, Pamungkas, and Jaenudin 2022).

Effectiveness in Improving Creative Thinking Skills

The N-Gain value of 0.66 (medium category) represents meaningful improvement considering the complex nature of creative thinking development. Creative thinking requires sustained practice to develop fully (Gunawan et al., 2022) and the medium improvement in four meetings suggests the e-module successfully initiated this process. Several factors explain the medium rather than high improvement: first, students needed time to adapt to neuroscience-based approaches; second, developing creative thinking requires breaking away from routine problem-solving patterns, which is inherently challenging (Andiyana, Maya, and Hidayat 2018). Nevertheless, the improvement from 42 to 80 (nearly doubling performance) is pedagogically significant and aligns with previous studies showing well-designed e-modules effectively support creative thinking development (Hasanah et al. 2023; Prayogi, Nurhamidah, and Rohiat 2022).

3. The Role of Neuroscience Principles

The e-module's effectiveness stems from systematic application of neuroscience principles. The preparation stage activates prior knowledge and emotional engagement, priming the brain for learning (Jensen 2008). Acquisition and elaboration stages promote multiple neural connections supporting flexible thinking

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(Yusmaliana and Suyadi 2019). Memory formation activities—incorporating relaxation and stretching—enhance memory consolidation and cognitive flexibility based on neuroscience research (Sirwanti 2018). The functional integration stage employs diverse assessments, strengthening neural pathways for creative problem-solving. This structured approach addresses multiple creativity dimensions: fluency, flexibility, and novelty (Aripin and Purwasih 2017).

4. Addressing Educational Challenges

The low baseline (pretest average 42) reflects broader challenges in Indonesian mathematics education, as evidenced by PISA results (OECD 2018). Traditional teaching emphasizes procedural fluency over creative problem-solving (Santi, Maimunah, and Roza 2019). The neuroscience-based e-module represents a paradigm shift by explicitly targeting brain functions associated with creativity. The medium improvement suggests that changing deeply ingrained learning habits requires sustained intervention beyond better materials alone. Future research should investigate long-term effects across different mathematical topics and diverse educational settings. Enhancements could include more scaffolded exercises, explicit creative thinking strategy instruction, metacognitive prompts, and collaborative learning activities to further boost effectiveness.

IV. CONCLUSION

This research successfully developed a neuroscience-based e-module for sequences and series material that meets high standards of validity, practicality, and effectiveness. The validation results from expert assessments yielded average scores of 3.88 for material aspects and 3.85 for media aspects, both categorized as very valid. The practicality test showed an excellent student response rate of 90.1%, indicating that the e-module is highly user-friendly and aligns well with students' learning needs. The effectiveness assessment demonstrated a medium-level improvement in mathematical creative thinking skills with an N-Gain value of 0.66, representing a substantial increase from pretest average of 42 to posttest average of 80.

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AUTHOR'S BIOGRAPHY

Dr. Nuranita Adiastuty, S.Si, M.Pd.

Born in Solo, April 17, 1982. Secretary of the study program and lecturer at Kuningan University. Bachelor of Statistics from Padjajaran University, Bandung, graduated in 2005; Master of Mathematics Education from Semarang State University, graduated in 2012; and Doctor of Mathematics Education from Semarang State University, graduated in 2023.

Winayu Pritya S. Pd., Gr.

Born in Kuningan, he is an alumnus of the Mathematics Education Study Program at Kuningan University. He is also an alumnus of the PPG Study Program at Gunung Jati University, Cirebon. He has received several awards, including first place in the microteaching competition at Holuoleo University and second place in the learning media competition at the Indonesian Education University, Bandung.

Dilla Dzahrotul Aeni

Born in Kuningan City on November 26, 2003. Final year student of Mathematics Education Study Program, Kuningan University.