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Brain Gym Math Based on Local Wisdom Using the Concrete, Representational, Abstract Method to Improve Creative Problem Solving in Students

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Abstrak

Penelitian ini dilatarbelakangi oleh rendahnya kemampuan creative problem solving matematika pada mahasiswa PG PAUD, yang memerlukan pendekatan inovatif dan kontekstual. Tujuan pengembangan ini adalah untuk menciptakan model Brain Gym Math berbasis kearifan lokal dengan metode CRA (Concrete, Representational, Abstract). Metode Research and Development (R&D) digunakan dengan melibatkan 70 mahasiswa sebagai sampel. Data dikumpulkan melalui tes, angket, dan wawancara, lalu dianalisis secara statistik deskriptif-inferensial dan kualitatif. Hasil validasi ahli menunjukkan model sangat layak (skor >3.5). Uji-t berpasangan membuktikan peningkatan signifikan (p<0,05) sebesar 22,6 poin pada kemampuan pemecahan masalah. Temuan kualitatif mengungkap dampak positif pada aspek kognitif, afektif, dan sosial. Implikasinya, model ini efektif meningkatkan keterampilan berpikir kreatif, pemahaman matematika, dan apresiasi budaya lokal, sehingga direkomendasikan untuk pembelajaran yang lebih bermakna.

Kata Kunci: *Brain Gym Math, CRA, Kearifan lokal, creative problem solving, Mahasiswa PGPAUD*

Abstract

This research is motivated by the low creative problem-solving ability of mathematics in PG PAUD students, which requires an innovative and contextual approach. The purpose of this development is to create a local wisdom-based Brain Gym Math model with the CRA (Concrete, Representational, Abstract) method. The Research and Development (R&D) method was used involving 70 students as samples. Data were collected through tests, questionnaires, and interviews, then analyzed using descriptive-inferential and qualitative statistics. Expert validation results showed the model was very feasible (score >3.5). The paired t-test proved a significant increase (p<0.05) of 22.6 points in problem-solving ability. Qualitative findings revealed positive impacts on cognitive, affective, and social aspects. The implication is that the model is effective in improving creative thinking skills, mathematical understanding, and appreciation of local culture, thus recommended for more meaningful learning.

Keywords: *Brain Gym Math, CRA, Kearifan lokal, creative problem solving, Early Childhood Education students*

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1. INTRODUCTION

The education system in Indonesia currently faces challenges in developing students' critical and creative thinking skills. Studies show that these skills are very important in preparing students to face increasingly complex life challenges (Hanik & Nurtamam, 2021; Nuramalia, 2023). *Creative Problem Solving (CPS)* is the ability to find solutions to problems in creative, flexible, and original ways, rather than relying solely on conventional methods(Zuhdi, 2021) . Data from the Ministry of Education and Culture (2023)shows that only 30% of PG PAUD students are able to solve math problems well, indicating the need for a more innovative approach to teaching mathematics.

High *Creative Problem Solving (CPS)* for prospective teachers (students) prepares them to face various complex learning situations with children in the classroom later on. This creates more competent educators, who in turn will be able to teach and stimulate similar skills in early childhood. However, there is a real problem, as evidenced by data from the Ministry of Education and Culture (2023), which shows that only 30% of PGPAUD students are able to solve math problems well. This situation indicates an urgent need for a more innovative approach to teaching mathematics to prospective teachers.

One approach that is considered effective is the CRA method, which allows students to understand various levels of abstraction of mathematical concepts (Apiati et al., 2024; Ramadhani et al., 2024). The development of *Brain Gym Math* based on local wisdom, is an effort to improve the creative mathematical problem-solving skills of PG PAUD students at Bengkulu University, which will serve as preparation for them as prospective early childhood education teachers. The main problem to be solved in this study is the low level of creative mathematical *problem solving* among early childhood education students. There is a need for relevant and innovative teaching strategies. Therefore, the *Brain Gym Math* model is needed as an effort to improve students' creative *problem solving*. This model is considered an innovative and contextual approach that is needed.

Therefore, the development of *Brain Gym Math* based on local wisdom using the CRA (*Concrete, Representational, Abstract)* method is expected to improve these abilities, which indicates a lack of relevant and adequate teaching strategies for the surrounding context that needs to be addressed (Cahyana et al., 2024; Fatmala & Kusno, 2023). The use of technology in education comes with new opportunities and obstacles. Digital education is one area that needs to be developed to improve the quality of education in today's world. Despite the challenges, developing a cultural approach to media is important for innovative leadership and, ultimately, the development of learning resources. The development *of Brain Gym Math* can utilize appropriate technology and local wisdom to meet these challenges (Ratna Pratiwi, 2022; Z Zahro, 2024).

This research is based on several key concepts, namely *Brain Gym*, the CRA method, and local wisdom. *Brain Gym* is a series of physical activities designed to improve brain function and facilitate learning (Dennison & Dennison, 1989). The CRA method consists of three stages: concrete, *representational*, and abstract, which enable students to understand mathematical concepts gradually. Local wisdom, on the other hand, encompasses knowledge and practices that already exist in society and can be used to enrich students' learning experiences.

Previous research shows that integrating local wisdom into mathematics teaching increases student motivation and learning outcomes, such as the ethnomathematics learning process that incorporates local culture to support students' understanding of the subject (Dede Rua et al., 2025; Karim et al., 2024). Local wisdom in this case is the value system and customs of a community that can serve as a source of learning through the integration of local cultural values in a multicultural education context aimed at promoting a more supportive learning environment (Setiawati et al., 2021).

The development of *Brain Gym Math* is combined with physical activities to improve students' concentration and memory (Nababan & Kartini Ompusunggu, 2024; Santoso et al., 2022). The integration of local wisdom from the community can serve as a context for teaching, which in turn enables students to understand and apply mathematical concepts in real life (Nurcahya & Rakhmayanti, 2023). The *Brain Gym Math* model based on local wisdom can provide a more interesting and relevant learning experience for students by integrating both innovations in improving *problem solving*. This improvement is expected to strengthen students' *creative problem solving* and affirm their cultural identity through the pragmatic values of local wisdom.

This approach will enable this study to provide more insight into the integration of local knowledge in mathematics teaching, which is in line with the current educational paradigm that emphasizes the development of students' character and critical thinking skills (Ermailis, 2022; Sunarti, 2021). The research is expected to form the basis for curriculum and pedagogy development in higher education institutions throughout Indonesia ( ), even though many studies have investigated local wisdom in education, there is still a gap in the application of certain teaching methods, particularly in mathematics. Many previous studies have focused on theoretical aspects and have been limited to analyses that do not provide specific evidence of the application of local wisdom in mathematics teaching (Sari et al., 2024).

CRA and local wisdom have been extensively researched. CRA is explicitly referred to in two key studies as an approach that enables the improvement of learning practices through an action cycle involving planning, action, observation, and reflection. These two studies show that CRA can strengthen the practical integration of local wisdom values in university and school classrooms and learning programs (Misnah et al., 2021; Suardi & Syarifuddin, 2018). The emphasis on repetitive cycles and professional reflection by teachers is key to the successful implementation of local wisdom content in a real learning context, but there is still a gap in the literature linking the two in higher education, especially in early childhood education. This study aims to fill this gap by developing a learning model that integrates CRA with local wisdom. This approach is expected to design more effective strategies in improving students' problem-solving abilities (Pratiwi & Shidqi, 2025).

The urgency of this research lies in the need to develop appropriate teaching practices that help develop students' academic potential while respecting the local cultural context. Given the era of globalization, students are expected to demonstrate critical and creative higher-order thinking skills that can be used in diverse situations (Dewi et al., 2024). This research is expected to contribute to the development of the Bengkulu University curriculum, more specifically for the PG PAUD study program, by using methods based on local wisdom, not only learning mathematics but also appreciating local culture. Furthermore, this research has the potential to be used as a case study by other educational institutions that want to integrate local wisdom into teaching. The novelty of this research combines CRA and local wisdom with the addition of Brain Gym as a physical and cognitive activator. This is a new holistic learning model (physical, cognitive, and socio-cultural) that has not been found in the literature before.

The study aims to develop localized *Brain Gym Math* to improve creative problem solving among PG PAUD students at Bengkulu University. This study aims to find evidence supporting the effectiveness of the CRA approach in the context of mathematics integrated with local culture. It also aims to find empirical evidence of the effectiveness of this approach in encouraging critical and creative thinking skills among students. The development of *Brain Gym Math* based on local wisdom using the CRA method can increase the potential to improve the *creative problem-solving* skills of PGPAUD students at Bengkulu University. The integration of local wisdom enhances students' learning experiences while teaching appropriate cultural moral values that are urgently needed in teaching and learning in Indonesia. It is hoped that this research, through the stated approach, will make a positive contribution to the development of mathematics education in Indonesia and serve as a starting point for further research on the integration of local wisdom into the teaching and learning process.

2. METHOD

Research Design

This study uses the *Research and Development* (R&D) method with a *mixed methods* approach. The *mixed methods* approach was chosen to combine quantitative and qualitative data in order to obtain a comprehensive picture of the development and effectiveness of the *Brain Gym Math* model based on local wisdom using the CRA method. The R&D method was used to produce a valid, practical, and effective learning module. The research procedure went through the following stages: 1) Development of *a definition* of the needs analysis for *Brain Gym Math* based on local wisdom, 2) Development *of a design*, namely preparing a conceptual framework for the *Brain Gym Math* method and learning tools based on local wisdom, 3) *Development*, namely the development stage involving validation tests or assessing the feasibility of *Brain Gym Math* based on local wisdom, and 4) *Dissemination*, in the implementation of the research subject in order to increase students' *creative problem solving* in designing *brain gym math* based on local wisdom.

Population and Sample

The population in this study included all students of the Early Childhood Education Study Program (PG PAUD) at Bengkulu University, totaling around 200 students. From this population, a sample of 70 students was taken to serve as research subjects, and 29 of them served as informants who received a post-test score average of 80 for *problem solving*. The sample selection was conducted using purposive sampling, where the selected students had diverse backgrounds in mathematical s and learning experiences. This was important to ensure that the research results could reflect broader conditions and provide a comprehensive picture of the effectiveness of the developed program.

Development Procedure

The procedure for developing this model adapted the simplified R&D steps from Borg & Gall, the flow of which is described below. Needs Analysis & Literature Review. A literature review was conducted to examine theories on *Brain Gym*, the CRA method, and the integration of local wisdom in learning, with the following stages: 1) Designing a model from the initial draft of the product in the form of a local wisdom-based *Brain Gym Math* learning module, complete with guidelines for lecturers and activities for students. 2) Expert validation of the draft model by experts in the fields of Mathematics Education and Early Childhood Education to assess the feasibility of the content, methodology, and other aspects. 3) Revision of the initial model based on input and suggestions from expert validators for refinement. 4) Field testing of the validated model implemented on a sample group. Pretest and posttest data on creative problem-solving abilities were collected at this stage. 5) Qualitative data collection through semi-structured interviews conducted with some students after model implementation to gain an in-depth understanding of their experiences. 6) Data analysis & final revision of all data (quantitative and qualitative) to test the effectiveness of the model. 7) Final product with the production of the final *Brain Gym Math* model that has been tested for feasibility and effectiveness.

Research Instruments

The data in this study were collected using several techniques and instruments designed in accordance with the research objectives. The instruments were divided into two main categories for quantitative and qualitative data collection.

The first quantitative data instrument is an expert validation sheet. This sheet uses a Likert scale (1-4) and is given to subject matter experts and media experts to assess the feasibility of the model. The first indicators assessed include interest, engagement, concept mastery, application of local wisdom, method effectiveness, and satisfaction with the model. The second quantitative instrument is a student response questionnaire, which uses a percentage scale. This questionnaire aims to measure students' perceptions and acceptance of the applied model, with indicators including interest, engagement, concept mastery, application of local wisdom, method effectiveness, and satisfaction with the model. The third quantitative instrument is the *Creative Problem Solving* test, which uses essay questions in the form of *a pretest* and *posttest* to measure students' creative problem-solving abilities. This test is designed to assess four indicators: fluency (the ability to generate many ideas), flexibility (the ability to generate diverse ideas), originality (the ability to generate unique ideas), and elaboration (the ability to develop ideas in detail).

Qualitative data was collected using semi-structured interviews as the main technique. This technique was used to explore students' experiences in depth after the model was implemented. The interview guidelines were compiled with indicators that focused on cognitive impacts (such as concept understanding and focus), affective impacts (such as motivation, interest, and self-confidence), and social impacts (such as collaboration and interaction). In addition to interviews, observation sheets were also used to record student activities and interactions that occurred during the learning process.

Data Analysis

The data obtained from the problem-solving ability test will be analyzed using a qualitative approach, namely descriptive statistics, and a quantitative approach in the form of inferential analysis. Descriptive analysis is used to describe the characteristics of the respondents and the test results, while inferential analysis, such as the t-test, is used to determine whether there is a significant difference between students' problem-solving abilities before and after participating in the learning process. In addition, data from questionnaires and observation sheets will also be analyzed to obtain a more holistic picture of the effectiveness of the developed module. Use of data analysis

3. RESULTS AND DISCUSSION

To validate the feasibility and validity of the model, it was tested by experts in the fields of Mathematics and Early Childhood Education and Development. This validation aimed to ensure the critical elements of the *Brain Gym Math* model based on CRA and local wisdom. The experts' ratings on several indicators are presented in Table 1 below.

Table 1. Expert Validation Results for the CRA-Based *Brain Gym* Mathematical Model and Local Wisdom

Aspects Assessed	Average Score (1-4)	Description
Content Suitability	3.75	The content of the material is in line with existing local wisdom.
Learning Methodology	3.8	The CRA method is considered effective and easy to implement.
Usefulness	3.9	This model is believed to enhance *Creative Problem Solving*.
Ease of Implementation	3.65	Several aspects need to be adjusted for ease of teaching.
Innovation in Learning	3.85	The *Brain Gym* approach provides educational innovation.
Relevance to the Curriculum	3.7	Aligned with educational objectives and local cultural context.
Supporting Facilities	3.55	Some facilities still need to be improved to support the method.
Student Acceptance	3.9	And the results of the trial show very good acceptance by students.

From Table 1, it can be concluded that the developed model is highly valid and suitable for implementation. All elements assessed received an average score above 3.5 (out of 4). The elements of usefulness and acceptance by students received the highest scores. This shows that experts in the field agree that this model is likely to improve students' creative problem-solving skills. However, there were comments regarding elements related to ease of implementation and supporting facilities that need further adjustment to ensure smooth field implementation.

The implementation of the model in the learning process, in which student responses are measured, is to assess student acceptance and perception of the effectiveness of the *Brain Gym Math* model based on CRA. *The proportion of* student *responses* is captured in several indicators and presented in detail in Table 2. Data from Table 2 shows that student feedback on the learning model used is very positive. Most indicators of interest, participation, and method effectiveness are in the "Very Good" category with percentages above 80%. This reinforces the integration of *Brain Gym* movements, the CRA approach, and local wisdom in promoting a positive, interactive, and effective learning environment for teaching problem-solving concepts and skills to students.

Before conducting further hypothesis testing, data prerequisite analysis, including normality testing and homogeneity of variance testing, must be performed. The normality test using *the One-Sample Kolmogorov-Smirnov Test* aims to determine whether the residuals are normally distributed. The other is a test for homogeneity of variance using Levene's Test, which aims to determine whether there is equal variance in the pretest and posttest data. The results of both tests are presented in Table 3 and Table 4.

Table 2. Student Responses to the Application of the CRA-Based *Brain Gym* Math Model

Response Indicators	Response Percentage (%)	Category
Interest in Learning	82	Very Good
Involvement in Learning Activities	85	Very Good
Mastery of Mathematical Concepts	78	Good
Application of Local Wisdom in Learning	80	Good
Effectiveness of the *Brain Gym* Method	83	Very Good
Satisfaction with the Learning Model	81	Very Good
Ease of Understanding the Material Taught	79	Good
Problem-solving skills after learning	84	Very Good

Table 3. Normality Test

N		70
Normal Parameters [a, b]	Mean	.000000
	Std. Deviation	1.10737075
Most Extreme Differences	Absolute	.097
	Positive	.097
	Negative	-.044
Test Statistic		.097
Asymp. Sig. (2-tailed)		.099[c]

Table 4. Test of Homogeneity

		Levene Statistic	df1	df2	Sig.
Problem solving (%)	Based on Mean	3.381	1	68	.070
	Based on Median	3,274	1	68	.075
	Based on Median and with adjusted df	3.274	1	63.737	.075
	Based on trimmed mean	3,395	1	68	.070

From Table 3, the Asymp. Sig. (2-tailed) value = 0.099 ($p > 0.05$) indicates that the residuals are normally distributed. Furthermore, the results of Levene's Test in Table 4 for the problem-solving ability variable obtained a Sig. value of 0.070 ($p > 0.05$). Therefore, it can be concluded that the data variance is homogeneous. The fulfillment of these two parameters allows us to continue testing the hypothesis using a paired samples t-test.

In testing the effectiveness of the localized *Brain Gym Math* model using the CRA method in improving creative problem-solving skills, a comparison of students' pretest and posttest scores was analyzed. Hypothesis testing was conducted using *a Paired Samples T-Test* to determine whether there was a significant difference between the two scores. The results of the statistical test are presented in Table 5.

Table 5. *Pretest* and *Posttest of Brain Gym Math* Based on Local Wisdom Using *the CRA (Concrete, Representational, Abstract) Method* in Improving *Creative Problem Solving of* PGPAUD Students at Bengkulu University

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
pre-test post-test	--22.60000	6.99565	.83614	-24.26805	-20.93195	-27.029	69	.000

The results obtained in Table 5 show a very significant difference between the pretest and posttest scores with *a t-value* of -27.029 and *Sig*. (2-tailed) 0.000 (< 0.05). There is an average difference of -22.60, which indicates a significant increase in scores after the treatment. Therefore, it can be interpreted that the application of the *Brain Gym Math* model based on local wisdom using the CRA approach has been proven to improve *the Creative Problem Solving* of PGPAUD students at Bengkulu University.

In addition to quantitative data, this study is also supported by qualitative findings from interviews with 29 students. The interviews were conducted to explore the students' experiences and perceptions of the application of this model. Based on interviews with 29 PGPAUD students at Bengkulu University, it can be concluded that the application *of the Brain Gym* Math model based on CRA has a positive impact cognitively, affectively, and socially. Cognitively, students find it easier to understand abstract concepts because of the physical movements that help them focus, improve their memory, and clarify the learning process from concrete to abstract through the CRA method. In addition, the integration of local wisdom in learning makes mathematics material more relevant to everyday life and strengthens contextual understanding. Affectively, students stated that learning became more enjoyable, interactive, and able to eliminate the boredom that usually arises in learning mathematics. There was an increase in motivation, confidence, and courage in expressing opinions. Meanwhile, from a social perspective, *Brain Gym* activities create a more lively and collaborative classroom atmosphere that supports positive interactions among students. Thus, overall, students assessed that the application of the CRA-based *Brain Gym* Mathematics model is effective in improving conceptual understanding, fostering learning motivation, encouraging creativity, and strengthening the connection between mathematics, local culture, and real life (Interviews in June, July, August 2025).

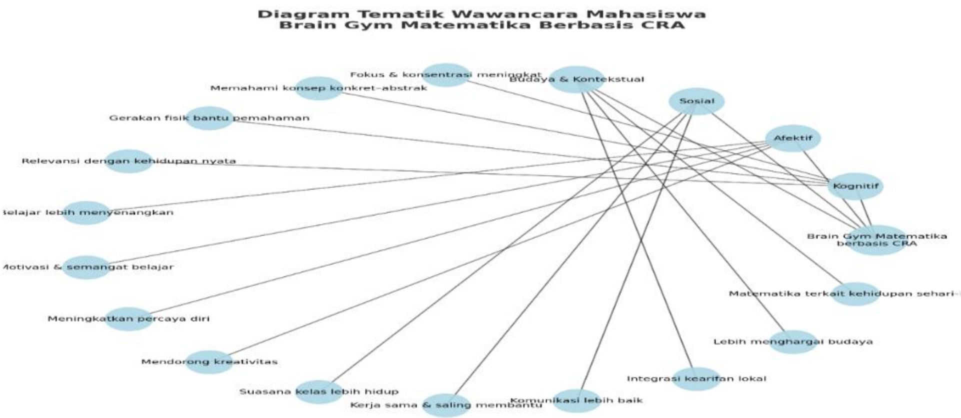

Figure 1. Thematic Diagram of Student Interviews

This study was supported by qualitative findings obtained from semi-structured interviews with 29 PGPAUD students at Bengkulu University. These interviews were conducted to gain an in-depth understanding of the students' experiences and perceptions of the application of the CRA-based *Brain Gym Math* model. The interviews revealed positive impacts in several aspects, including:

a) Cognitive impact (improved conceptual understanding), where students reported that they found it easier to understand abstract mathematical concepts. This was supported by two main factors: first, the physical movements of *Brain Gym* helped improve focus and memory, and second, the CRA method helped the learning process move from the concrete to the abstract stage. In addition, the integration of local wisdom was considered successful in making mathematics material more relevant to everyday life, thereby strengthening students' contextual understanding. b) Affective impact (fostering motivation) began with an affective change in the learning atmosphere. Students stated that learning became more enjoyable and interactive, and was able to eliminate the boredom they usually felt when learning mathematics. This has a direct impact on increasing learning motivation, building self-confidence, and increasing students' courage in expressing their opinions. c) Social impact (strengthening social skills) from the social side, *Brain Gym* activities, which are often carried out communally, have been proven to create a more lively and collaborative classroom atmosphere and support positive interactions between students. d) Cultural impact (fostering cultural appreciation) integrated with local wisdom in this learning model explicitly fosters cultural appreciation. Students not only learn mathematics, but also see the direct connection between academic material and their local culture and real life.

The interview results show that the CRA-based *Brain Gym Mathematics* model is effective in improving concept understanding, fostering motivation, strengthening social skills, and fostering cultural appreciation. This thematic analysis confirms that learning innovations that combine physical movement, cognitive structure, and cultural context can create a more meaningful mathematics learning experience for students. Physical movement in *Brain Gym* plays a significant role in activating brain hemisphere coordination and improving focus, which can support students in their transition from the concrete to the representational and abstract stages of mathematics learning. Research shows that physical activities involving cross-movement can improve brain integration, resulting in significant cognitive benefits. Sajodin et al. argue that the physical movements performed in *Brain Gym* allow both hemispheres of the brain to function simultaneously, which is important for cognitive mastery and improving student concentration(Sajodin et al., 2023) . These physical activities serve to build better connections in the nervous system, allowing students to more easily move from concrete understanding to more abstract representations.

Quantitatively and qualitatively, this study confirms that the *Brain Gym Math* model with CRA and local wisdom is not only capable of improving students' creative problem-solving skills, but also their motivation, as well as the integration of mathematics, culture, and real life. These findings also reinforce the results of the study "(Pratama et al., 2022) that expanding perspectives by synchronizing the physical movements of *Brain Gym* into the local cultural context can create a more holistic learning experience. This is because combining motor, cognitive, and affective aspects in the learning process can increase the effectiveness of learning outcomes. The importance of incorporating students' cultural identities into the teaching and learning process, which can help improve academic achievement, strengthen positive identity, and encourage critical thinking(Caingcoy, 2023) . This study shows that a local approach not only increases the relevance of learning but also improves the effectiveness of the CRA method in the context of higher education, especially for prospective early childhood teachers.

The results of this study indicate that the application of the CRA-based *Brain Gym Math* model combined with local wisdom is effective in improving *the Creative Problem Solving* of PG PAUD students at Bengkulu University. These findings are supported by both quantitative and qualitative data. From a quantitative perspective, the expert validation results (Table 1) show that this model is considered relevant, useful, and easy to apply, although there are several limitations related to supporting facilities in increasing motivation and collaboration during the learning process. Student responses (Table 2) show a high level of acceptance, with 85% involvement in learning and 84% problem-solving ability. This indicates that this model is capable of creating a more meaningful learning experience that suits the needs of students. The results of normality and homogeneity tests (Tables 3 and 4) show that the data can be analyzed with parametric tests, and the results of the paired t-test (Table 5) provide empirical evidence of a significant increase of 22.6 points in students' *Creative Problem Solving* after the application of the model.

The 22.6-point increase in *Creative Problem Solving* scores indicates a meaningful shift from the "moderate" category (pretest mean of 57.4) to the "high" category (posttest mean of 80.0). Based on *Cohen's effect size* calculation of 1.12, this increase falls into the large effect category, indicating that the influence of the *Brain Gym Math* model on students' creative problem-solving abilities is substantial, not just statistically significant. Pedagogically, this increase shows that students are not only able to generate more ideas (*fluency*), but also more diverse (*flexibility*) and original in solving problems. This is important in the context of early childhood education teacher training, as creativity and *problem-solving* skills are core competencies for prospective educators who will face a variety of learning situations with children.

Qualitatively, the interview results reinforce the quantitative findings by showing that this model has a positive impact on cognitive, affective, and social aspects. Students find it easier to understand abstract concepts through the CRA approach, are more motivated and confident in their learning, and are more active in collaborating with their peers. The integration of local wisdom also makes learning more contextual and relevant to everyday life. These findings are in line with research by Karim et al. (2024) and Rua et al. (2025), which states that the integration of local wisdom in mathematics learning can increase learning motivation and concept understanding.

The results of this study on the development of *Brain Gym Math* based on local wisdom using the CRA *(Concrete, Representational, Abstract)* method are a strategic step to improve *the creative problem solving* of early childhood education students at Bengkulu University. The CRA method has been proven effective in various previous studies, showing that this approach can improve students' critical thinking and creativity skills. This research is in line with Fauzi's (2024) research, which states that challenge-based learning that adopts the CRA approach provides an interesting learning experience and can have a positive impact on students' problem-solving skills and creativity.

Research conducted byKhalid et al (2020)emphasizes that *the Brain Gym Math-based approach* adopting CRA can improve learning experiences, where students who follow this method show a significant increase in creative thinking abilities compared to students who learn using traditional methods. In addition, the fulfillment of cognitive needs plays an important role in their ability to think creatively in the context of mathematics (Kılıç et al., 2022; Sri Verawati & Wahyudi, 2024). By integrating local wisdom into the development *of Brain Gym Math*, students are expected to feel the connection between mathematics learning and their daily lives, which can foster motivation and interest to learn more deeply and solve problems creatively. Research supports these findings, where the use of interactive applications in mathematics learning has been proven to improve students' problem-solving skills (Jonsson et al., 2022).

The use of locally-based representations can enhance students' creative thinking and engagement (Gawise et al., 2022). This shows that the focus should not only be on mastering mathematical concepts, but also on integrating local wisdom that can help students understand and apply concepts in real-life situations. This holistic approach, which includes the social and cultural context of students, has the potential to bring significant benefits in the development of creative problem-solving skills.

Research on problem-based learning also shows that learning that involves active community participation can improve overall learning outcomes (Hidayati et al., 2020). This approach is in line with the importance of local wisdom in creating relevant learning experiences and fostering a sense of ownership of the material being studied. Therefore, the integration of local wisdom in *Brain Gym Math* not only supports the development of students' mathematical skills but also strengthens their relationship with the local community and culture.

Learning media developed for local contexts can increase the validity and relevance of learning materials for students (Uge et al., 2019). This shows the importance of providing learning resources that are appropriate to students' backgrounds so that they can utilize local wisdom as part of their learning strategies. This has the potential to increase student engagement and learning outcomes.

The development of *Brain Gym Math* based on local wisdom using the CRA method has great potential in improving *the Creative Problem Solving* of PG PAUD students. The integration of theory, practice, and local culture in mathematics learning will not only improve students' academic skills but also build strong character and good relationships with the community. This research will provide the empirical data needed to understand special education practices for early childhood education teacher candidates in Indonesia that are more responsive to the local cultural context.

Overall, the results of this study confirm that the integration of *embodied cognition* theory, Vygotsky's ZPD, and Bandura's *social cognitive* theory comprehensively explains the effectiveness of the CRA-based Brain Gym Math model and local wisdom. Physical movement plays a role in activating cognitive processing, social *scaffolding* through local culture expands the learning zone, and social support strengthens students' motivation and self-confidence. The synergy of these three aspects makes mathematics learning not only academically meaningful, but also contextual and humanistic in line with the goals of 21st-century education.

4. CONCLUSION

This study proves that the development *of Brain Gym Math* based on local wisdom using the CRA *(Concrete, Representational, Abstract)* method is effective in improving *the Creative Problem Solving* of PG PAUD students at Bengkulu University. Expert validation results show that the developed model is very feasible to implement, with an average score above 3.5 in various aspects. Trials with students showed very positive responses, as indicated by 85% learning engagement and an 84% increase in problem-solving skills. Paired t-tests also confirmed a significant increase in posttest scores compared to pretest scores, with an average difference of 22.6 points. Qualitative findings through interviews reinforced the quantitative results, in which students felt cognitive, affective, and social benefits. Thus, this learning model not only improves understanding of mathematical concepts and creative thinking skills but also fosters motivation, appreciation of local culture, and better social interaction. This study emphasizes the importance of integrating local wisdom in the development of innovative learning media to strengthen the 21st-century skills of prospective early childhood education teachers.

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6. REFERENSI

Apiati, V., Heryani, Y., Hermanto, R., & Muzdalipah, I. (2024). Pelatihan pengembangan perangkat pembelajaran berbasis kurikulum merdeka melalui model PjBL pada Guru MGMP SMA Se-Kota Tasikmalaya. *Catimore Jurnal Pengabdian Kepada Masyarakat*. https://doi.org/10.56921/cpkm.v3i1.158

Cahyana, N., Rustiani, S., Djafar, S., & Nurdin, N. (2024). Literature review: Lembar Kerja Peserta Didik (LKPD) matematika berbasis geogebra. *Journal of Education Research*. https://doi.org/10.37985/jer.v5i4.1574

Caingcoy, M. (2023). Culturally responsive pedagogy. *Diversitas Journal*. https://doi.org/10.48017/dj.v8i4.2780

Pratama, R. N., Purwanti, C., Rosmiarti, Sansuwito, T. Bin, & Said, F. M. (2022). The effectiveness of brain gym on the cognitive abilities of children at TK ABA 17 Palembang, Indonesia. *Malaysian Journal of Medical Research*. https://doi.org/10.31674/mjmr.2022.v06i02.002

Sajodin, S., Alfin, R., & Yualita, P. (2023). Improving short term memory through the brain gym method. *Abdimas Jurnal Pengabdian Masyarakat*. https://doi.org/10.35568/abdimas.v6i3.3299

Zuhdi, R. (2021). Pengaruh pembelajaran IPA menggunakan model creative problem solving dengan smartphone terhadap kreativitas dan inovasi siswa. *Jurnal Kridatama Sains Dan Teknologi*. https://doi.org/10.53863/kst.v3i02.209

Dede Rua, M. O., Fono, M. A., & Wewe, M. (2025). Pembelajaran matematika berbasis etnomatematika di satuan pendidikan. *J.C.M.P.* https://doi.org/10.38048/jcmp.v3i1.4402

Dennison, P. E., & Dennison, G. E. (1989). *Brain gym: teacher's edition (revised)*. Edu-Kinesthetics, Inc.

Dewi, S., Azizah, I. N., & Wawan, W. (2024). Eksplorasi konsep matematika pada metode jarimatika Al-Qur'An. *DPJPM*. https://doi.org/10.61650/dpjpm.v2i1.533

Ermailis, E. (2022). Penerapan metode penemuan dalam pembelajaran sebagai upaya peningkatan pemahaman siswa terhadap konsep matematika siswa kelas VIII Di MTs N 4 Kota Jambi. *Jurnal Literasiologi*. https://doi.org/10.47783/literasiologi.v8i1.348

Fatmala, E. A., & Kusno, K. (2023). Analisis berpikir kreatif pada pembelajaran matematika. *Didactical Mathematics*. https://doi.org/10.31949/dm.v5i2.5175

Gawise, G., Tolla, I., & Manda, D. (2022). The validity and practicality of pancasila and civic education learning model based on local wisdom. *Universal Journal of Educational Research*. https://doi.org/10.13189/ujer.2022.100108

Hanik, U., & Nurtamam, M. E. (2021). *Integrasi etnomatematika dalam pembelajaran matematika sekolah dasar*. https://doi.org/10.31219/osf.io/724b6

Hidayati, N. A., Waluyo, H. J., Winarni, R., & Suyitno, S. (2020). Exploring the implementation of local wisdom-based character education among Indonesian higher education students. *International Journal of Instruction*. https://doi.org/10.29333/iji.2020.13213a

Jonsson, B., Mossegård, J., Lithner, J., & Wirebring, L. K. (2022). Creative mathematical reasoning: does need for cognition matter? *frontiers in psychology*. https://doi.org/10.3389/fpsyg.2021.797807

Karim, A., Faridah, E., Surya, E., Bukit, N., & Idawati, I. (2024). Penerapan metode penemuan terbimbing untuk meningkatkan kemampuan pemahaman konsep dan pemecahan masalah. *Asimetris Jurnal Pendidikan Matematika Dan Sains*. https://doi.org/10.51179/asimetris.v5i1.2404

Kementerian Pendidikan dan Kebudayaan. (2023). *Ikhtisar data pendidikan tinggi tahun 2022/2023*.

Khalid, M., Saad, S., Abdul Hamid, S. R., Tony Abdullah, M. R., Ibrahim, H., & Shahrill, M. (2020). Enhancing creativity and problem solving skills through creative problem solving in teaching mathematics. *Creativity Studies*. https://doi.org/10.3846/cs.2020.11027

Kılıç, A., Salinas-Hernández, U., Kock, Z., & Pepin, B. (2022). Studying mathematics students' learning experiences in challenge-based education. *Proceedings of the International Conference on Education*. https://doi.org/10.5821/conference-9788412322262.1443

Misnah, M., Supriatna, N., & Baso Malla, H. A. (2021). Integrating nosampesuvu values in history learning as a conflict resolution in central sulawesi. *paramita historical studies journal*. https://doi.org/10.15294/paramita.v31i1.22724

Nababan, M. J., & Kartini Ompusunggu, V. D. (2024). Sosialisasi penggunaan mathway dalam pembelajaran matematika di SMA Pencawan Medan. *Nauli*. https://doi.org/10.35335/nauli.v2i2.142

Nuramalia, S. (2023). *Jurnal Pengaruh Metode Bernyanyi Terhadap Peningkatan Hasil Belajar Matematika Di Sekolah Dasar*. https://doi.org/10.31219/osf.io/ckxzq

Nurcahya, M. A., & Rakhmayanti, F. (2023). Pembelajaran matematika berbasis math edutainment dalam meningkatkan kemampuan pemecahan masalah matematis bagi peserta didik kelas V Di SDN Cicalengka 08. *Primary Jurnal Keilmuan Dan Kependidikan Dasar*. https://doi.org/10.32678/primary.v15i2.9449

Pratama, R. N., Purwanti, C., Rosmiarti, Sansuwito, T. Bin, & Said, F. M. (2022). The Effectiveness of brain gym on the cognitive abilities of children at TK ABA 17 Palembang, Indonesia. *Malaysian Journal of Medical Research*. https://doi.org/10.31674/mjmr.2022.v06i02.002

Pratiwi, I. A., & Shidqi, D. S. (2025). Developing merdeka curriculum teaching module based on local wisdom to foster rahmatan lil alamin character in early childhood. *Aulad: Journal on Early Childhood*, *8*(2), 766–777. https://doi.org/10.31004/aulad.v8i2.1081

Ramadhani, A., Andas, N. H., Suryadi, R., Aninsih, P., Karman, K., Pratiwi, A., Abin, R., Syam, H., Yawan, H., & Kadaruddin, K. (2024). Implementasi kegiatan numerasi pada program kampus mengajar 7 Di SD Negeri 1 Puuroda. *Swarna Jurnal Pengabdian Kepada Masyarakat*. https://doi.org/10.55681/swarna.v3i7.1426

Ratna Pratiwi, N. K. (2022). The pengembangan bahan ajar ipa berbasis multirepresentasi terhadap pemahaman konsep siswa SMP: Sebuah Tinjauan Studi. *Jurnal Pendidikan Mipa*. https://doi.org/10.37630/jpm.v12i2.614

Santoso, S., Indriyani, D., & Janna, H. (2022). Peningkatan pembelajaran matematika melalui pendampingan bagi peserta didik SDN 2 Sumberkolak. *Mimbarintegritas*. https://doi.org/10.36841/mimbarintegritas.v1i1.1472

Sari, E. R., Adri, D., Rizkayanti, A., & Rimayasi, R. (2024). Pelibatan alat peraga matematika realistik terhadap peningkatan hasil belajar siswa di sekolah dasar. *Edukatif Jurnal Ilmu Pendidikan*. https://doi.org/10.31004/edukatif.v6i1.6021

Sajodin, S., Alfin, R., & Yualita, P. (2023). Improving short term memory through the brain gym method. *Abdimas Jurnal Pengabdian Masyarakat*. https://doi.org/10.35568/abdimas.v6i3.3299

Setiawati, T., Yanuarsari, R., & Maulani, S. (2021). Penerapan metode bermain dalam mengembangkan kemampuan matematika awal dimasa belajar dari rumah. *Indonesian J. Adult. Community. Educ.* https://doi.org/10.17509/ijace.v3i2.43595

Sri Verawati, N. N., & Wahyudi, W. (2024). Raising the issue of local wisdom in science learning and its impact on increasing students' scientific literacy. *Ijete*. https://doi.org/10.33394/ijete.v1i1.10881

Suardi, S., & Syarifuddin, S. (2018). Penerapan model pembelajaran saintifik approacd berbasis media pembelajaran kearifan lokal pada mata kuliah dasar-dasar sosiologi dalam membangun karakter dan meningkatkan hasil belajar mahasiswa pendidikan sosiologi Universitas Muhammadiyah Makassar. *Jed (Jurnal Etika Demokrasi)*. https://doi.org/10.26618/jed.v3i2.1627

Sunarti, S. (2021). Peningkatan hasil belajar siswa pada mata pelajaran matematika dengan menggunakan metode pembelajaran matematika gasing di sekolah dasar. *Tanggap Jurnal Riset Dan Inovasi Pendidikan Dasar*. https://doi.org/10.55933/tjripd.v2i1.263

Uge, S., Neolaka, A., & Yasin, M. (2019). Development of social studies learning model based on local wisdom in improving students' knowledge and social attitude. *International Journal of Instruction*. https://doi.org/10.29333/iji.2019.12323a

Z Zahro, U. M. (2024). Kepemimpinan berbasis nilai-nilai islam dalam menyongsong era pendidikan digital. *Edium*. https://doi.org/10.35905/edium.v2i1.7772