Methods of Developing Creative Thinking through Mathematical Problem-Solving Techniques

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DOI: 10.63467/alls14.art5

Abstract

This study evaluates various problem-solving methods and their contribution to the development of creative thinking in young schoolchildren and as a specific objective the identification of the most effective methods in the development of creative thinking. Twenty-eight second-grade students participated in the study, which was divided into four groups, depending on the methods used to solve mathematical problems. Each group used different problem-solving techniques to solve mathematical problems: the method of mathematical logic, the method of visual representations, a teamwork method of decomposition and reassembly (used by computer scientists when developing new software), and a teamwork method of solving problems through games. The Torrance test (Technical and Normative Manual) was used to evaluate creative thinking - verbal form A (for testing) and form B (for retesting). After obtaining the scores, they were entered into the SPSS program - Statistical Package for Social Sciences. Results show that the methods used to solve mathematical problems play a significant role in the development of creative thinking in young schoolchildren and that mathematical games have the greatest impact on the development of creative thinking in young schoolchildren.

Keywords: mathematical problem-solving, creative thinking, creativity, primary school teaching.

JEL Classification: I2, C02.

1. Introduction

Creative thinking is the ability to generate novel ideas or solutions in problem-solving (Hadar & Tirosh 2019). This definition builds on Guilford's (1967) division of creativity into nine constructs: fluency, flexibility, novelty, synthesis, analysis, reorganization/redefinition, complexity, and elaboration.

The development of creative thinking in children is one of the greatest challenges of modern education, and mathematics, by its nature, offers the ideal framework for stimulating its development. In this paper, we aim to highlight the importance of problem-solving methods and strategies in developing creative thinking in young schoolchildren. Creative thinking can be enhanced by problem-solving skills, as it is shown by various studies conducted (Ndiung & Menggo 2024; Chaiyarat 2024). However, it is difficult to cultivate students' creative thinking, when the teaching is limited to textbooks and teaching courseware produced by teachers, making the classroom boring (Li & Zhang 2024). By designing suitable activities in the classroom, teachers can cultivate creative thinking and exploit this in other study areas.

Often students tend to focus on solving routine problems rather than developing their problem-solving skills, and more emphasis should be placed on non-routine problem-solving abilities (Nuryadin et al. 2023). Suryanto et al. (2021) argue that training students to determine problems, convey ideas, and generate creative solutions needs to be the main goal of learning activities. The creative process is conducted by giving assignments to be completed creatively, not by giving the answers or the technique. When the teacher provides all the necessary information and techniques, the students are replicating the process. While this is a good practice for most students internalizing the algorithm and providing a solid knowledge for future problems could also be an inhibition when it comes to creative thinking. By applying the same methods and not constructing new ones, creative thinking cannot evolve.

Solving math problems involves creative techniques, but the methods applied may contribute differently to the development of creative thinking.

In the early school period, the learning process demands children's creativity intensely. When they enter school, children are exposed to continuous intellectual work, sometimes unknown to them. At this age, children naturally incorporate certain traits characteristic of creativity. The development of the potential for thinking and creativity is achieved through activities that require independence, investigation, and originality.

2. Literature Review

Harold (2024) states that creativity is not just a means for personal and individual expression, a way of admiring and showcasing the beauty and the spreading of important and valuable messages, but it can also consist of problem-solving and solution-finding for the world's greatest and most complex problems (Keen 2011), increasing comprehension and increase empathy (Decety & Cowell 2014) which can lead to positive and better ethical behavior (Haney 1994).

The opposition between critical and creative thinking is false, and it is mistaken to view them as radically different and unconnected (Bailin 1987). Innovation is a product of creativity which is not simply novelty but also valuable, and critical judgment is crucially involved in such creative achievement. When constructing a creative solution to a problem, the initial recognition that there is a problem to be solved, the identification of the nature of the problem, and the determination of how to proceed all involve critical assessment. Moreover, Bailin (1987) noted that creativity is not a question of generating fresh solutions to problems, but of generating better solutions, and thus it involves changes that are effective, useful, and significant.

In defining mathematical creativity, the classification of its components is often discussed between several types of creative thinking (Zhang et al. 2020). Moreover, mathematical creativity is widely acknowledged as one of the most important goals of mathematical education (Leikin & Pitta-Pantazi 2013; Leikin & Sriraman 2017; Mann 2006; Schoevers et al. 2019).

Sriraman (2005, p. 24) has provided a working definition of school-level mathematical creativity in which mathematical creativity is related to problem-solving and problem-posing. He defined mathematical creativity as the process that results in novel and/or insightful solution(s) to a given problem or analogous problems, or the formulation of new questions and/or possibilities that allow an old problem to be regarded from a new angle requiring imagination. Schoevers et al. (2019) consider that mathematical creativity also refers to the cognitive act of combining known concepts in an adequate, but for the pupil new way, thereby increasing or extending the pupil's understanding of mathematics. For example, when the student is constructing new concepts in mathematics using other experiences and knowledge or making connections with other subjects of study.

To promote mathematical creativity and creative thinking a pedagogical environment is needed. This is characterized by an open atmosphere in which students can develop new mathematical concepts in interaction with others, through collaboration or teamwork (Colucci-Gray et al. 2017; Kaufman et al. 2010).

Smare & Elfatihi (2024) found that in numerous studies published between 2010-2022, conducted on groups of students with ages between 3 and 14, a variety of pedagogical strategies yielded an immensely increase in creativity in problem-and-project-based learning strategies. This is because such tasks encourage risk-taking, resilience, experimentation, curiosity, and thus creativity (Albar & Southcott, 2021). Research also revealed a positive correlation between fact-finding and problem-finding with the number of ideas produced and the originality of these ideas (van Hooijdonk et al. 2020).

Moreover, Schoevers et al. (2019) found that most pedagogical strategies applied in schools are creativity enhancement strategies as well, but the regular mathematical lessons have a more specific learning goal than the interdisciplinary lessons, namely practicing arithmetical strategies versus learning about conceptualizations of shapes, space, and patterns. Thus, creativity is not a goal for a normal mathematical lesson, but rather a by-product of the learning strategies.

Through problem-solving, however, students are asked to construct or employ new methods to find the solution or the best solution. This helps develop creative thinking and creativity by identifying mathematical structures that lead to a different, more creative, set of opportunities ((Stein & Kaufman, 2010; Stein, Remillard, and Smith, 2007).

3. Methodology

Research objective and hypothesis

The general objective of this research is to identify and evaluate the importance of problem-solving methods in developing creative thinking in young schoolchildren. More specifically, the aim is to identify the most effective methods in the development of creative thinking. To this end, we have selected four methods to be applied to a group of students. Also, some of the students worked individually and some worked in teams, by collaboration.

Main hypothesis (H_M). We assume that the methods used to solve problems in mathematics have a significant role in the development of creative thinking in young schoolchildren.

Secondary hypothesis (H_S). We presume that some methods and strategies of problem-solving are more effective than others in the development of creative thinking in young schoolchildren. Teamwork could be more effective in developing creativity than individual work. This would be consistent with other results that show that cooperative learning remains a powerful pedagogical tool for teachers aiming to develop students' creative thinking (Chaiyarat 2024).

Subjects

The study involved twenty-eight second-grade students, 53.57% girls (N = 15) and 46.43% boys (N = 13), with ages between 7 and 9. They were divided into four groups, depending on the methods used to solve mathematical problems. Thus, group 1 used the method of mathematical logic, group 2 used the method of visual representations, group 3, the method of decomposition and reassembly, and, lastly, group 4, the method of solving problems through mathematical games. The last two groups were asked to work as teams, but the first two had to work individually.

Instruments

The research design is an experimental one with multiple groups, structured as follows:

- Batch selection and division: Participants (young schoolchildren) were randomly divided into four groups, with each group experimenting with a different method of solving math problems.
- Basic measurement: Before the intervention begins (application of problem-solving methods assigned to each group), data was collected on the level of creative thinking of the participants in each group using valid and reliable tools for measurement.
- Intervention: Each group receives specific instructions and materials to work with the assigned problem-solving method.
- Post-intervention measurement: After the groups have completed the activities specific to their method, data on the level of creative thinking of the participants in each group was collected again.
- Data analysis: Pre- and post-intervention data were compared for each group to assess changes in creative thinking after the application of the respective method.
- Interpretation of the results: It was analyzed whether there are significant differences between groups in terms of the growth of creative thinking and determine which method was most effective in achieving this goal.

For creative thinking data collection, the Torrance test (Technique and Normative Manual) (Torrance, 1966) was used for the evaluation of creative thinking – verbal form A (for testing) and form B (for retesting).

For the analysis of data, we have conducted SPSS (Version 26.0) calculations, the ANOVA test, and paired-sample t-tests.

Ethics

The ethical requirements in this work have been fully respected. All participants and their parents expressed their consent for participation in the research, and this was a fundamental aspect in ensuring respect for their rights and dignity. Participants' voluntary consent was obtained before the research began, giving them a clear understanding of the purpose of the study, the procedures involved, and the possible risks or benefits.

In addition, to protect data privacy, appropriate security measures have been implemented for the storage and management of participants' personal information. The data collected has been treated with confidentiality and has not been disclosed to third parties or unauthorized persons.

Intervention

The pedagogical intervention lasted six weeks, 18th of March to the 26th of April 2024, and constituted six different pedagogical activities for each group. All activities were gamified to ensure that the cooperation and interest of the students were kept. **Table 7** (Appendix) is a summary of the activities conducted in the pedagogical program.

Data analysis and results

Before intervention test results were compared between groups to ensure that the levels of creativity were similar since the selection was performed randomly.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	95% Confidence Interval for Mean Upper Bound	Minimum	Maximum
Mathematical logical method	7	89,4286	8,96023	3,38665	81,1417	97,7154	78,00	101,00
Visual representation method	7	93,5714	8,24332	3,11568	85,9476	101,1952	82,00	103,00
Decomposition and reassembly method	7	92,1429	9,90671	3,74438	82,9807	101,3050	79,00	106,00
Gamified problem-solving method	7	90,0000	11,41636	4,31498	79,4416	100,5584	73,00	110,00
Total	28	91,2857	9,30495	1,75847	87,6776	94,8938	73,00	110,00

Table 1. Descriptives
Creativity before intervention

The analysis of the data in **Table 1** shows that all four groups selected for the evaluation of creativity before the intervention obtained average scores above 89. Group 1 – which will use the Logical-mathematical method has an average of 89.43 and moderate variability (standard deviation of 8.96), with extreme values between 78 and 101. Group 2 – selected to use the Visual representation method has a higher average of 93.57 and a similar dispersion, with values between 82 and 103. Group 3 – which will solve the problems with the help of the Decomposition and reassembly method has an average of 92.14, but a slightly higher variability (standard deviation of 9.91), and the scores vary between 79 and 106. Finally, Group 4 which will use the gamified problem-solving method has an average of 90, but the highest variability (standard deviation of 11.42), with values between 73 and 110, indicating a wide dispersion of results. The overall mean is 91.29, with moderate variation (standard deviation of 9.30), suggesting a high level of creativity, with insignificant differences between participants.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	77,429	3	25,810	,274	,844
Within Groups	2260,286	24	94,179		
Total	2337,714	27			

Table 2. ANOVA. Creativity before intervention

Creativity before intervention

	Statistic[a]	df1	df2	Sig.
Welch	,293	3	13,254	,830
Brown-Forsythe	,274	3	22,596	,843

a. Asymptotically F distributed.

Table 3. Robust Tests of Equality of Means

Looking at the results in **Table 2** - ANOVA and **Table 3** - Robust Media Equality Tests for Pre-Intervention Creativity, the variability of creativity between groups is statistically insignificant. In ANOVA, the sum of squares between groups is 77.429, and the sum of squares within groups is much larger at 2260.286, indicating that most of the total variability (2337.714) comes from individual differences within groups, not from differences between groups. This is also supported by the F-value of .274, with a significance value (Sig.) of .844, much higher than the significance threshold of .05, suggesting that there are no statistically significant differences between groups in terms of creativity before the intervention.

From a psychological point of view, these results suggest that, before applying any methods of stimulating creativity, participants, regardless of the group they belonged to, had similar levels of creativity. The fact that significant variability comes from within groups indicates an individual diversity in creativity, but this diversity is not influenced by belonging to a particular group.

In **Table 3**, robust tests (Welch and Brown-Forsythe) confirm the ANOVA results, both of which have very low values for their statistics (.293 and .274), and the significance (Sig.) values of .830 and .843 are again much higher than the .05 threshold. These results indicate that the averages of creativity between groups are equal, and the differences observed are not large enough to be considered statistically significant.

Psychologically, the results in the tables confirm that the participants' level of creativity before the intervention was evenly distributed among the groups. This may suggest that subsequent interventions are the ones that will generate relevant differences, and this uniform starting point allows for a correct assessment of the effectiveness of those interventions.

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Creativity after intervention - Creativity before intervention	17,17857	11,38568	2,15169	21,59348	12,76367	7,984	27	,000

Table 4. Paired Samples Test

Analyzing the data in **Table 4** - Test for paired samples, a significant difference between creativity before and after the intervention is observed. The average difference between creativity before and after the intervention is 17.17857, which indicates a substantial increase in post-intervention scores. This difference is supported by a standard deviation of 11.38568, which shows moderate variation in how participants were affected by the intervention. The 95% confidence interval for the mean difference is between 21.59348 and 12.76367, which means that there is a high probability that the true mean difference is within this range, with all values being positive. This confirms that the intervention had a consistent impact on creativity, leading to an overall increase in scores.

The t-value is 7.984, with 27 degrees of freedom (df). This significantly positive t-value suggests that the intervention had a significant effect on the participants' creativity.

Psychologically, these results indicate that the intervention had a positive effect, leading to an increase in creativity levels. This consistent increase in scores indicates that the intervention was effective in stimulating creativity, promoting flexibility and fluidity in thinking, but also involving divergent ways of thinking.

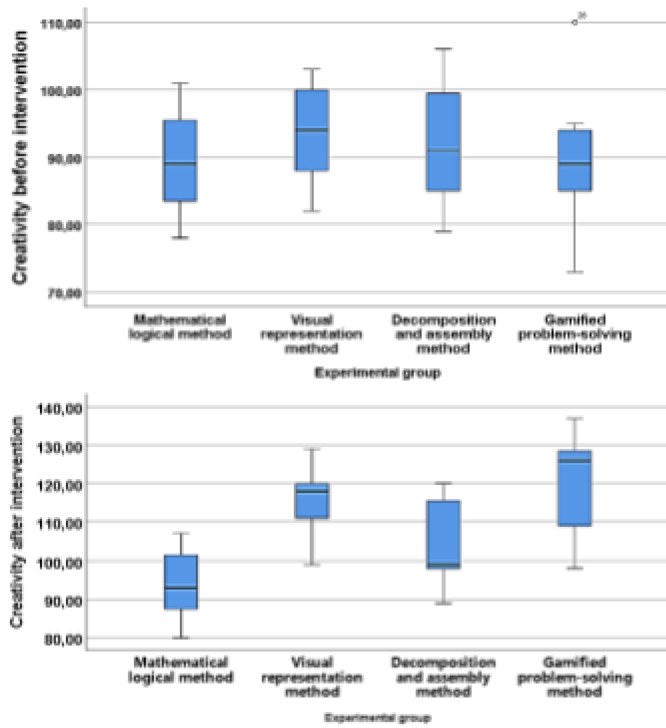

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Figure 1. Creativity before and after intervention

The box plot graph (**Figure 1**) shows the level of creativity after the intervention for four experimental methods: the logical-mathematical method, the visual representation method, the decomposition and reassembly method, and the problem-solving method through games. Regarding the statistical analysis, it is observed that the logical-mathematical method has the lowest median, suggesting that participants who used this method had the lowest increase in levels of creativity after the intervention, and the relatively narrow interquartile interval indicates a low variability in their performance.The visual representation method has a higher median than the logical-mathematical method, and the graph box suggests moderate variability, indicating that most participants scored higher, but there is a greater dispersion of results. The decomposition and reassembly method has a median like that of the visual method, but the interquartile range is wider, reflecting greater variability between participants' scores. In contrast, the method of problem-solving through games has the highest median of all methods, suggesting that it was the most effective in stimulating creativity, but also the most variable, indicated by the large interquartile interval and the length of the whiskers.

Psychologically, these results suggest that methods involving visual representation, decomposition-reassembly, and games stimulate creativity more effectively than the logical-mathematical method. The logical-mathematical method, which is based on sequential reasoning and structuring, seems to limit the creative capacity of the participants, leading to more modest results. On the other hand, the method of solving problems through games, which involves a more relaxed and exploratory approach, stimulates creativity at a higher level but is also the most unpredictable, reflecting the fact that some participants may be more receptive to playful approaches than others.

Dependent Variable: Creativity after intervention. Tukey HSD

					95% Confidence Interval	
(I) Experimental group	(J) Experimental group	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
Mathematical logical method	Visual representation method	-21,4286*	6,29193	,012	-38,7856	-4,0716
	Decomposition and reassembly method	-11,0000	6,29193	,322	-28,3570	6,3570
	Gamified problem-solving method	-25,4286*	6,29193	,003	-42,7856	-8,0716
Visual representation method	Mathematical logical method	21,4286*	6,29193	,012	4,0716	38,7856
	Decomposition and reassembly method	10,4286	6,29193	,367	-6,9284	27,7856
	Gamified problem-solving method	-4,0000	6,29193	,919	-21,3570	13,3570
Decomposition and reassembly method	Mathematical logical method	11,0000	6,29193	,322	-6,3570	28,3570
	Visual representation method	-10,4286	6,29193	,367	-27,7856	6,9284
	Gamified problem-solving method	-14,4286	6,29193	,128	-31,7856	2,9284
Gamified problem-solving method	Mathematical logical method	25,4286*	6,29193	,003	8,0716	42,7856
	Visual representation method	4,0000	6,29193	,919	-13,3570	21,3570
	Decomposition and reassembly method	14,4286	6,29193	,128	-2,9284	31,7856

Table 5. Multiple Comparisons.

Based on observed means.

The error term is Mean Square (Error) = 138,560.

*. The mean difference is significant at the,05 level.

The statistical analysis in **Table 5** - Multiple Comparisons reveals significant differences between certain experimental groups in terms of creativity after the intervention. The logical-mathematical method presents significant differences compared to the visual representation method, with an average difference of -21.43 (p = .012), and to the problem-solving method through games, where the average difference is -25.43 (p = .003). These results indicate that participants who used the logical-mathematical method had a significantly lower level of creativity after the intervention compared to those who used the methods of visual representation and problem-solving through games.

No significant differences were observed between the visual representation method, the decomposition and reassembly method, and the game-based problem-solving method, suggesting that these three had a similar impact on the participants' level of creativity. In conclusion, visual or game-based and problem-solving methods stimulated creativity to a greater extent than the logical-mathematical method, with no significant differences between them and the other methods.

From a psychological point of view, these results suggest that methods that involve visual representation and problem-solving through games are more effective in stimulating creativity, probably due to the activation of more flexible, intuitive, and exploratory cognitive processes. In contrast, the logical-mathematical method, which is based on sequential reasoning and structuring, seems to limit creativity, which may indicate that rigorous and logical thinking does not optimally favor the expression of creativity. It suggests that participants benefited more from playful and visual approaches, which allowed them to think divergently and explore more innovative solutions.

Dependent Variable: Difference. Tukey HSD

(I) Experimental group	(J) Experimental group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
Mathematical logical method	Visual representation method	-17,2857*	3,54082	,000	-27,0535	-7,5180
	Decomposition and assembly method	-8,2857	3,54082	,117	-18,0535	1,4820
	Gamified problem-solving method	-24,8571*	3,54082	,000	-34,6249	-15,0894
Visual representation method	Mathematical logical method	17,2857*	3,54082	,000	7,5180	27,0535
	Decomposition and assembly method	9,0000	3,54082	,079	-,7677	18,7677
	Gamified problem-solving method	-7,5714	3,54082	,170	-17,3392	2,1963
Decomposition and assembly method	Mathematical logical method	8,2857	3,54082	,117	-1,4820	18,0535
	Visual representation method	-9,0000	3,54082	,079	-18,7677	,7677
	Gamified problem-solving method	-16,5714*	3,54082	,001	-26,3392	-6,8037
Gamified problem-solving method	Mathematical logical method	24,8571*	3,54082	,000	15,0894	34,6249
	Visual representation method	7,5714	3,54082	,170	-2,1963	17,3392
	Decomposition and assembly method	16,5714*	3,54082	,001	6,8037	26,3392

Table 6. Multiple Comparisons

Based on observed means.
The error term is Mean Square (Error) = 43,881.
*. The mean difference is significant at the,05 level.

The statistical analysis in **Table 6** - Multiple Comparisons (Tukey HSD) shows that the logical-mathematical method shows significant differences compared to the visual representation method and the game problem-solving method, with mean differences of -17.29 and -24.86, respectively, both with a meaning p = .000. This indicates that participants who used the logical-mathematical method recorded a significantly smaller increase in creativity compared to those who used visual or gamified methods. Also, the decomposition and reassembly method differs significantly from the game problem-solving method, with a difference of -16.57 (p = .001), suggesting that the gamified method stimulated creativity more than the decomposition and assembly method. In conclusion, visual and game-type methods seem to be much more effective in maintaining or increasing creativity, while the logical-mathematical method has a modest impact on the creativity of the participants.

From a psychological point of view, results show that visual and gamified methods stimulate creativity more effectively, compared to the logical-mathematical method. This suggests that creative thinking is supported by approaches that encourage divergent thinking, imagination, and flexible exploration of solutions, such as visual representation and problem-solving through games. The logical-mathematical method, which involves sequential reasoning and rigorous structuring, seems to limit creativity, probably because of its orientation towards convergent thinking and strict problem-solving, which leaves no room for the free expression of new and innovative ideas. Similarly, the decomposition and reassembly method shows better results than the logical-mathematical method, but not as efficient as the gamified method, which suggests that decomposing complex problems into smaller and reassembling the solutions can stimulate creativity, but not in the same manner problem-solving in play. These results highlight the importance of creative approaches that allow participants to manifest their cognitive flexibility and use their imagination in a more open and exploratory way.

Regarding the hypothesis of the study, we point out that the (H_M) has been confirmed for the studied sample. Therefore, solving mathematical problems can boost creativity levels in primary school students. Our secondary hypothesis has been confirmed as well, and the results show that the gamified problem-solving technique has the biggest impact on developing and enhancing creativity levels. Nevertheless, the other methods used in the study had a significant impact on the creativity levels of the students.

4. Results and Discussions

The mathematical logic method has been shown to have less impact on creative thinking and creativity development compared to the other methods. This can be explained by the structured and predictable nature of the logical approach, which encourages sequential reasoning and determinate solutions, but can limit creative exploration. Students are guided to follow clear steps to reach a solution, which can reduce opportunities to think "outside the box" (Yayuk et al. 2020).

The method of visual representations had a significantly greater impact than the method of mathematical logic. This suggests that the use of images, graphs, and visual models stimulates creative thinking by offering varied ways of perceiving and solving problems. Visual representations help students make connections between different concepts and develop their ability to visualize alternative solutions (Walia 2012). This approach encourages mental flexibility and adaptability, which are essential for creative thinking.

The method of decomposition and reassembly, and as a form of organization of teamwork has demonstrated a great impact on creative thinking, even if not as great as that of visual representations, emphasizing the importance of collaboration and social interaction in the learning process. The collaborative process facilitates the development of innovative solutions and helps students see problems from multiple perspectives, thus stimulating divergent thinking and creativity (Temel & Altun 2022).

The method of solving problems through mathematical games had the greatest impact on the development of creative thinking. Math games often involve "play" scenarios that are open-ended and exploratory, allowing students to experiment and learn through trial and error. These activities encourage students to think strategically and develop innovative solutions in an enjoyable and motivating way. Games create an environment where mistakes are viewed as learning opportunities, not failures, which reduces performance anxiety and encourages creative exploration (Beka 2017).

Also, the study shows that mathematics is a suitable platform to foster creativity. It proved that solving problems in groups is effective in fostering creativity (Khalid et al. 2020).

Moreover, teachers should consider integrating gamified problem-solving activities to increase creativity and the interest of the students. We acknowledge that this requires extra effort on the part of the teacher since they should function as a coach, a provider of resources, and a designer, facing complex and varied challenges (Calavia, Blanco & Casas 2021), but creativity and creative thinking is a skill that is necessary for the future, in a world that is constantly changing due to the technological advancement that is happening every day.

5. Conclusions

The study shows that the methods used to stimulate creativity had different effects on the participants. The methods of visual representation and problem-solving through games proved to be the most effective in maintaining and increasing the level of creativity, giving participants greater freedom of expression and stimulating divergent thinking. These methods allowed the exploration of multiple and innovative solutions, contributing to an increased level of post-intervention creativity.

In contrast, the logical-mathematical method had a limited effect on creativity, leading to a slower, but statistically significant, increase in creativity after the intervention. This suggests that strict and structured reasoning, specific to convergent thinking, is less conducive to expressing creativity, as it requires rigid and predictable solutions. Although the decomposition and reassembly method performed better than the logical-mathematical method, it did not stimulate creativity as effectively as visual or gamified methods.

In conclusion, the study highlights that creative approaches that favor cognitive flexibility, free exploration, and divergent thinking, such as games and visual representation, are much more effective in stimulating creativity. Methods that rely on strict and structured reasoning, such as the logical-mathematical method, tend to inhibit creativity, limiting participants' ability to generate innovative ideas.

Psychologically, the results of this study suggest that approaches that encourage exploration, collaboration, and play have a strong effect on the development of creative thinking in young schoolchildren. Methods that allow for multiple open-ended solutions and strategies are more effective in stimulating creativity than those that follow a rigid set of steps.

These findings coincide with psychological theories of active learning and constructivism, which emphasize the importance of active engagement and social interaction in the learning process. They suggest that to develop creative thinking, it is essential to create learning environments that allow students to explore, collaborate, and learn through practical and playful experiences.

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