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Implementing a STEAM-Based Character Makeup Learning Model for Performance Arts in Elementary Education

Ririn Amaliah Putri Sarah*, Husnul Azizah, Nacua Nabila, Winda Safitri Siregar, Aurellia Nurkhafizah Lisra, Hazimah Wardah Tuljannah

Pendidikan Vokasional Tata Rias, Institusi Seni Indonesia Padangpanjang
*Correspondence: E-mail: ririnamaliah25@gmail.com

ABSTRACT

This study investigated how effective a STEAM-based Character Makeup Learning Model is in boosting creativity among fifth-grade students at SD 28 Batang Anai. It employed a one-group pretest–posttest design with 28 students who took part in four STEAM-integrated sessions involving character makeup projects. Creativity was evaluated across four dimensions using a validated rubric. Classroom observations assessed how well STEAM components were implemented. Results revealed a significant increase in overall creativity, with the average score rising from 62.40 at pretest to 70.40 at posttest. A paired-sample t-test confirmed a statistically significant difference ($t(27) = 4.23$, $p = 0.0002$), with a Cohen's d of 0.80, indicating a moderate-to-large effect. Specific gains in dimensions were: fluency (+2.80), flexibility (+2.70), elaboration (+3.10), and originality (+3.40), showing notable improvements across all creativity facets. Classroom observations showed high overall STEAM implementation (78%), with Arts and Science as the strongest areas, while Engineering needed more scaffolding. Character makeup product assessments demonstrated consistent progress, with 35% of students reaching high performance post-intervention. These findings suggest that incorporating performance arts into STEAM learning effectively promotes multidimensional creativity in elementary students.

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1. INTRODUCTION

Twenty-first-century elementary education requires learning approaches that go beyond content mastery to foster creativity, problem-solving skills, collaboration, and technological literacy from an early age (UNESCO, 2021). Contemporary curricula emphasize that learning should serve as a medium for developing higher-order thinking skills and preparing students to respond to increasingly complex and dynamic global challenges (OECD, 2020). In this context, the STEAM approach (Science, Technology, Engineering, Arts, and Mathematics) has gained recognition as an integrative framework that supports holistic competency development through meaningful interdisciplinary learning experiences (Yakman & Lee, 2020). Empirical studies have consistently shown that STEAM-based learning contributes positively to elementary students' creativity, design thinking, and collaborative abilities (Johnston et al., 2022; Lage-Gómez & Ros, 2024).

Despite its potential, the implementation of STEAM in elementary classrooms remains limited. Instructional practices in many schools continue to rely on teacher-centered, theory-driven approaches, with insufficient integration across subject areas, thereby limiting opportunities for artistic exploration within multidisciplinary learning contexts (Park & Ko, 2021). Teachers often struggle to position the arts as a core component of instruction due to limited pedagogical knowledge and the absence of practical, structured instructional models (Huang & Li, 2023). Even within arts education, learning activities frequently emphasize final products rather than the exploratory, reflective, and collaborative processes that characterize effective STEAM pedagogy (Lin & Chen, 2020). This situation reveals a persistent gap between curriculum expectations and classroom practices.

A further gap is evident in the limited use of the performing arts as integrated learning experiences in elementary education. Previous studies indicate that performance-based arts projects significantly enhance students' creativity, self-confidence, social empathy, and communication skills (Kenny & Wirth, 2021). However, in school practice, performance arts are often treated as extracurricular or supplementary activities rather than as pedagogical strategies embedded within core instructional processes (Noh & Shen, 2023). Consequently, the instructional potential of performance arts to support STEAM-oriented competency development remains largely underutilized (Chung, 2022).

These challenges are closely related to ongoing debates concerning the role of the "Arts" component within STEAM education. Some scholars conceptualize the arts as a supportive element that enhances creativity, visualization, and expression in science and technology learning (Land, 2021). In contrast, other perspectives position the arts as an equal and central domain that drives exploration, meaning-making, and creative perception within project-based learning environments (Perignat & Katz-Buonincontro, 2022). While these perspectives differ, they collectively underscore the need for clear, contextual, and pedagogically sound STEAM models, particularly for elementary education settings.

Within this framework, character makeup for school performances represents a promising yet underexplored learning medium. Character makeup activities allow students to engage in visual storytelling, emotional expression, facial form analysis, and color harmony through hands-on creative processes. These activities also foster collaboration during performance preparation and naturally align with STEAM components, including science through color mixing and light, technology through the use of digital references and design tools, engineering through the planning of simple costumes and props, and visual arts as the core of creative expression. Recent research suggests that project-based and art-integrated

learning effectively enhances students' creative thinking, particularly when creativity is examined across multiple dimensions, including fluency, flexibility, elaboration, and originality (Afrijal et al., 2023; Pramashela et al., 2023; Tran et al., 2021). Nevertheless, a review of the literature from the past five years indicates a lack of structured instructional models that explicitly integrate STEAM-based character makeup learning within elementary school performance contexts.

In light of these gaps, this study examines the implementation of STEAM-based character makeup instruction for school performances in elementary education. The study aims to investigate its effectiveness in improving students' creativity, both overall and across specific creativity dimensions, using a one-group pretest–posttest design. Specifically, this research seeks to determine whether the implementation of STEAM-based character makeup learning leads to a significant improvement in elementary students' creativity and to examine how it influences each dimension of creativity, namely fluency, flexibility, elaboration, and originality. Accordingly, the hypotheses are formulated as follows: H0 posits that there is no significant difference in students' creativity scores before and after the implementation of STEAM-based character makeup learning, whereas H1 posits that there is a significant difference in students' creativity scores before and after the implementation of STEAM-based character makeup learning.

To ensure conceptual clarity and measurement consistency, the variables in this study are operationally defined. STEAM-based character makeup learning is a project-based instructional approach that integrates science, technology, engineering, the arts, and mathematics through the design and application of character makeup for elementary school performances, emphasizing hands-on creative processes, collaboration, problem-solving, and the integration of artistic and scientific concepts. Creativity refers to students' creative ability as demonstrated in character makeup design activities and is measured using a validated performance rubric encompassing four dimensions: fluency, defined as the number of ideas or design alternatives generated; flexibility, defined as the diversity of approaches and design variations; elaboration, defined as the level of detail and refinement in design execution; and originality, defined as the uniqueness and novelty of the designs produced.

2. METHODS

This study used a quantitative approach with a quasi-experimental one-group pretest–posttest design. In this design, one intact class was observed before and after the implementation of the learning intervention. This approach enabled examination of changes in students' creativity resulting from STEAM-based character makeup learning activities. The design was considered appropriate because the study was conducted in a real classroom setting where random assignment and control groups were not feasible.

The participants were fifth-grade students from SD 28 Batang Anai. In total, the population consisted of 56 students from two parallel classes. One class was selected as the research sample using purposive sampling. The selection was based on several practical considerations, including students' readiness to participate in project-based learning, teacher support, and the availability of time for implementing STEAM-oriented activities. Based on these criteria, Class V-B, consisting of 28 students, was chosen for the study. Using an intact class allowed the learning process to take place naturally without disrupting regular classroom activities.

The study's independent variable was the STEAM-based character makeup learning model,

which integrates science, technology, engineering, the arts, and mathematics through character makeup activities for school performances. The dependent variable was students' creativity, conceptualized as a multidimensional ability. In this study, creativity was examined through four dimensions: fluency, flexibility, elaboration, and originality, reflecting students' ability to generate ideas, vary approaches, develop details, and produce unique designs.

Data were collected using performance-based instruments to capture students' creativity in an authentic learning context. A creativity test was administered before and after the intervention. In this task, students were asked to design and conceptualize character makeup, allowing their creative ideas and understanding to be observed. Students' final makeup products were also assessed using a performance rubric that focused on technical accuracy, suitability to the character, aesthetic quality, and creative expression. To ensure that the learning activities were consistently aligned with STEAM principles, classroom observations were conducted using a STEAM observation checklist. All instruments were reviewed by experts in arts education and character makeup to ensure content validity. Reliability testing showed that all instruments had acceptable internal consistency, with Cronbach's alpha values of 0.70 or higher.

The research procedure consisted of three main stages. First, students completed a pretest to identify their initial level of creativity. Next, the intervention was implemented across four learning sessions. During these sessions, STEAM elements were integrated into character makeup activities. Students learned about facial anatomy, lighting, and color theory; used digital images and design references; planned makeup steps and materials; applied makeup creatively by exploring texture, color blending, and character expression; and used basic mathematical concepts such as facial proportions and symmetry. Throughout the learning process, students' participation and the implementation of STEAM components were observed. After the intervention, students completed a posttest and produced a character makeup artwork, which was evaluated using the same rubric to identify changes in creativity.

Data were analyzed using a paired-samples t-test to compare students' creativity scores before and after the intervention. Before conducting the test, data normality was assessed using the Shapiro–Wilk test because the sample size was less than 50. The results showed that both pretest and posttest scores were normally distributed ($p > 0.05$), indicating that parametric analysis was appropriate. To understand the strength of the intervention's effect, Cohen's d was calculated to determine the effect size.

3. RESULTS AND DISCUSSION

3.1 Results

This section reports the quantitative results of the study examining the effects of the STEAM-based Character Makeup Learning Model on fifth-grade students' creativity at SD 28 Batang Anai. The findings include descriptive statistics, paired-samples t-test results, effect-size analysis, STEAM implementation levels, and character makeup product assessment outcomes.

Table 1. Descriptive Statistics of Creativity Scores

Variable	Mean	SD	Min	Max
Pretest Creativity	62.40	8.90	46	78
Posttest Creativity	70.40	8.05	52	88
Gain Score	8.00	—	—	—

The descriptive analysis shows a clear improvement in students' creativity following the

implementation of the STEAM-based learning model. Prior to the intervention, students' creativity scores were in the medium category, with a mean score of 62.40 (SD = 8.90). After the four STEAM-integrated instructional sessions, the posttest mean increased to 70.40 (SD = 8.05), representing an average gain of 8.00 points. This indicates a positive shift in overall creative performance after the intervention.

To examine whether this improvement was statistically significant, a paired-sample t-test was conducted.

Table 2. Paired Sample t-Test Results

Comparison	Mean Difference	t	df	p (2-tailed)	Cohen's d
Pre → Post	8.00	4.23	27	0.0002	0.80

The results revealed a significant difference between pretest and posttest creativity scores, t(27) = 4.23, p = 0.0002. The effect size analysis yielded a Cohen's d value of 0.80, indicating a moderate-to-large effect. This suggests that the STEAM-based Character Makeup Learning Model had a meaningful impact on students' development of creativity.

The results of classroom observations conducted during four STEAM-integrated instructional sessions. The observations were conducted to examine the extent to which the Science, Technology, Engineering, Arts, and Mathematics components were implemented during the learning process. The summary is shown in Table 3.

Table 3. STEAM Implementation Observation Results

STEAM Component	Number of Indicators	% Achieved	Category
Science	6	80%	High
Technology	5	76%	High
Engineering	5	72%	Moderate–High
Arts	6	82%	High
Mathematics	4	78%	High
Overall Average	26	78%	High

Classroom observations conducted during the four instructional sessions indicated that the overall level of STEAM implementation was categorized as high (78%). Among the STEAM components, Arts and Science achieved the highest implementation levels, followed by Mathematics and Technology. Engineering obtained the lowest score, although it still fell within the moderate-to-high category. These results suggest that while the STEAM framework was implemented effectively overall, the engineering component requires further instructional strengthening.

The Product Assessment of Character Makeup Categories presents the distribution of character makeup product outcomes in a clear, structured visual format.

Table 4. Character Makeup Product Rubric Scores

Aspect	Pretest Mean	SD	Posttest Mean	SD	Gain
Character Accuracy	2.07	0.41	2.79	0.42	+0.72
Technique	1.96	0.47	2.68	0.45	+0.72
Aesthetics	2.11	0.38	2.85	0.39	+0.74
Creativity	2.18	0.42	2.95	0.40	+0.77
Overall Mean	2.08	0.42	2.82	0.41	+0.74

Analysis of students' character makeup products revealed consistent improvement across all assessed aspects. The greatest gains were observed in visual creativity, aesthetics, and technical execution. The overall mean score increased from 2.08 in the pretest to 2.82 in the posttest. In terms of category distribution, there was a notable shift after the intervention: no students remained in the low category, while 35% of students reached the high category. This distribution reflects qualitative improvements in students' creative products alongside quantitative gains in creativity scores.

Overall, the results demonstrate that the STEAM-based Character Makeup Learning Model effectively enhanced students' creativity, as evidenced by both test performance and the quality of creative products produced during the learning process.

3.2 Discussion

The findings of this study indicate that the STEAM-based Character Makeup Learning Model significantly enhanced fifth-grade students' creativity at SD 28 Batang Anai. The paired-sample t-test showed a substantial increase in posttest creativity scores ($t(27) = 4.23$, $p = 0.0002$) with a Cohen's d of 0.80, suggesting a moderate-to-large effect of the intervention. These results align with prior research indicating that STEAM learning environments support the development of creative thinking, problem-solving skills, and collaboration in elementary students (Johnston et al., 2022; Lage-Gómez & Ros, 2024). The integration of the arts into STEM through project-based activities, such as character makeup, provides students with meaningful, context-rich, and interdisciplinary learning experiences, thereby reinforcing the arguments presented in the introduction (Yakman & Lee, 2020).

Examining the creativity dimensions, the greatest improvements were observed in elaboration and originality. Open-ended and visually expressive tasks, such as character makeup design, provided students with opportunities to refine details and generate unique ideas. This is consistent with Kim (2022), who reports that children exhibit higher creative performance when tasks emphasize imaginative elaboration and personal expression. Similarly, Sugiyama et al. (2023) highlight that arts-based activities provide a flexible cognitive space for generating complex and original ideas. These findings confirm that the creative processes inherent in character makeup—such as color blending, texture experimentation, and interpretation of facial expressions—directly support greater elaboration and originality.

Classroom observations revealed that the Arts and Science components had the highest levels of implementation, reflecting students' engagement in visual expression and scientific

understanding, including facial anatomy, color theory, and lighting. Technology and Mathematics achieved moderate-to-high levels, particularly when students utilized digital tools for design prototyping and applied basic measurement and symmetry principles. Engineering was the lowest-scoring component, highlighting challenges in structured planning, material selection, and sequential problem-solving. This observation underscores the pedagogical implication that teachers should provide explicit scaffolding, modeling, and step-by-step guidance for engineering tasks while maintaining the creative freedom essential to arts activities (Margot & Kettler, 2021; Wang & Kim, 2022).

Analysis of students' character makeup products demonstrated consistent improvement across all dimensions—creativity, aesthetics, technical execution, and character accuracy—with the overall mean increasing from 2.08 to 2.82. The distribution of product assessment categories also shifted positively: no student remained in the low category, and 35% achieved a high rating. These results reinforce the importance of integrating performance arts into core classroom practices rather than treating them as supplementary or extracurricular activities (Chung, 2022; Noh & Shen, 2023). By embedding arts into project-based STEAM instruction, students experienced both quantitative gains in creativity scores and qualitative improvements in creative product outcomes.

Despite these promising results, some limitations should be noted. The one-group pretest–posttest design is vulnerable to threats to internal validity, such as maturation, history, and testing effects, as gains could potentially be influenced by factors outside the intervention (Chu et al., 2021). Additionally, the study was conducted with a relatively small sample from a single school, which limits generalizability. Future research should involve larger, more diverse populations, include control groups, and employ longitudinal designs to evaluate the sustainability of creativity development over time (Li & Francis, 2022).

Pedagogically, this study highlights several important implications. First, integrating performance arts into STEM subjects creates rich, interdisciplinary learning environments that actively promote creativity, problem-solving, and 21st-century competencies. Teachers are encouraged to balance guided instruction with open-ended exploration, use digital tools for iterative design, and explicitly connect scientific and mathematical concepts with creative processes. Providing scaffolding for engineering tasks, emphasizing collaboration, and prioritizing process over product can further enhance students' technical and problem-solving skills. Collectively, these strategies offer a practical, structured, and student-centered approach to STEAM implementation in elementary classrooms, supporting meaningful engagement and the development of creativity from multiple dimensions.

In conclusion, the STEAM-based Character Makeup Learning Model effectively enhances elementary students' creativity and offers a replicable framework for integrating the arts into STEM instruction. By leveraging project-based learning and interdisciplinary connections, educators can foster both creative expression and analytical thinking, aligning with contemporary curriculum goals for 21st-century education. With targeted reinforcement of engineering tasks and continued application across diverse classroom contexts, this model

holds strong potential for broader adoption in elementary arts and STEAM education.

4. CONCLUSION

The findings of this study indicate that the STEAM-based Character Makeup Learning Model effectively enhances the creativity of fifth-grade students at SD 28 Batang Anai. Students demonstrated significant improvements in overall creativity scores, particularly in elaboration and originality, while the quality of character makeup products also improved across all assessed dimensions. These results confirm that integrating performance arts with STEAM principles provides a meaningful and engaging context for fostering creativity in elementary education.

Despite these positive outcomes, the Engineering component performed relatively poorly compared with the other STEAM elements, suggesting a need for enhanced instructional support in planning, sequencing, and technical execution of creative tasks. Future implementations should incorporate more structured scaffolding, guided modeling, and step-by-step problem-solving exercises to strengthen students' engineering skills within creative projects.

Practical classroom implications include: teachers can use character makeup projects to integrate arts with science, mathematics, and technology in a hands-on, collaborative way; structured checklists and rubrics can help students track progress and reflect on their creative processes; and digital design tools can be employed to prototype ideas before final execution. By adopting this model, educators can provide students with a stimulating environment that nurtures both artistic expression and 21st-century competencies, while promoting critical thinking, collaboration, and problem-solving skills in authentic learning experiences.

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