International Journal of Research and Review
[Indexed, Peer-Reviewed Journal]
Volume 12; Issue: 6; June 2025
Website: www.ijrrjournal.com
Research Paper *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

The Influence of STEAM-Containing Activities on Fine Motor Skills of Group B Children at Auladuna Kindergarten, Bengkulu City

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DOI: https://doi.org/10.52403/ijrr.20250678

ABSTRACT

This study aims to examine the influence of STEAM learning activities on the fine motor skills of Group B children at Auladuna Kindergarten in Bengkulu City. A quantitative research design was employed, using a quasi-experimental approach with a nonequivalent control group. The study involved 40 children, divided into two groups: 20 children in the experimental group (exposed to STEAM activities) and 20 children in the control group (not exposed to STEAM activities). Data were collected through observation, interviews, and documentation. The analysis was conducted using the independent sample t-test to assess the differences in fine motor skill development between the two groups. Prior to conducting the t-test, normality and homogeneity tests were performed to ensure the data were suitable for statistical analysis. The results revealed a significant difference in fine motor skills between the two groups, with the experimental group showing greater improvement. The independent sample t-test showed a t-value of 3.767 and a p-value of 0.001, indicating that the difference was statistically significant ($p < 0.05$). These findings suggest that STEAM activities positively influence the development of fine motor skills in early childhood. It is recommended that early childhood educators at Auladuna Kindergarten, and similar institutions, integrate STEAM approaches to enhance fine motor skill development in young children.

Keywords: STEAM, fine motor skills, early childhood

INTRODUCTION

Early childhood education (PAUD) is an important foundation in the holistic development of individuals. Early childhood, especially in the age range of 4-6 years, is often referred to as the golden age, where children's brain development is very rapid and determines the direction of further development (Suyadi, 2017). Therefore, it is important for education providers, especially in PAUD institutions, to provide appropriate stimulation so that children's potential can develop optimally. One important aspect in early childhood development that requires special attention is fine motor skills.

Fine motor skills are a child's ability to use small muscles, especially the hands and fingers, to perform various activities such as drawing, writing, cutting, stringing, and so on. These skills not only function in the physical aspect, but are also closely related to the child's academic learning readiness, including writing skills and eye-hand coordination (Hurlock, 2002). Therefore, the development of fine motor skills is an important indicator in the assessment of early childhood growth and development.

Sari & Agustriana (2024) explain that fine motor skills in early childhood involve several important aspects. First, motor control refers to a child's ability to control fine movements with their hands and fingers, such as holding and using tools with precision. Furthermore, fine motor skills support the development of cognitive processes, such as when children engage in activities like drawing or assembling puzzles, which help develop problem-solving skills and spatial thinking. The development of fine motor skills is gradual and varies from one child to another, so it is important to provide children with opportunities to practice in order for their skills to develop over time. Such practice can be achieved through creative activities and play that involve using their hands and fingers. In the context of education, fine motor skills are crucial as they form the foundation for other academic skills, such as writing, reading, and mathematics. Good coordination between hands and fingers is also needed to complete tasks accurately, such as drawing straight lines or cutting shapes neatly.

(Sari et al., 2024) emphasize the significance of fine motor skills development in early childhood education, particularly through the integration of project-based learning and local culture. Their study suggests that this approach not only enhances students' critical thinking skills but also fosters fine motor skills through hands-on activities that require precise hand and finger coordination. Such activities, including crafting and problem-solving tasks, support both cognitive and motor skill development by encouraging accuracy, creativity, and deeper engagement with the content.

In practice, many PAUD institutions have not integrated learning activities that can develop fine motor skills optimally and enjoyably. Monotonous learning approaches, lack of challenging activity variations, and limited teaching aids and materials can be inhibiting factors in the development of these skills. Therefore, there needs to be learning innovation that can stimulate children's fine motor skills in a structured manner and integrated with other developmental needs.

The approach that is considered effective and relevant to develop fine motor skills as well as other aspects of development is the STEAM approach. STEAM is an acronym for Science, Technology, Engineering, Art, and Mathematics. This approach emphasizes project-based learning and comprehensive and integrated exploration. Through the STEAM approach, children are not only invited to think critically and creatively, but also to carry out activities that involve motor coordination, problem solving, collaboration, and communication (Yakman, 2008).

Integrating the STEAM approach into PAUD learning can provide a meaningful and enjoyable learning experience. Activities such as making bridges from ice cream sticks, creating patterns from recycled materials, making artwork from seeds, or designing simple tools from natural materials, not only stimulate thinking skills, but also train children's fine motor skills. These kinds of activities provide space for children to be creative while using their hands actively in the learning process.

Several studies have shown that the implementation of the STEAM approach in early childhood learning has a positive impact on various aspects of development, including fine motor skills. Research by Nugroho and Lestari (2021) revealed that the use of STEAM-based activities can improve children's fine motor coordination through stringing, printing, and assembling activities. In addition, STEAM activities have also been shown to increase children's active involvement in learning, thereby creating an atmosphere that supports the growth of motivation and creativity (Putri & Wahyuni, 2020).

In the local context, namely in TKIT Auladuna Bengkulu City, it is important to adopt a contextual learning approach that is in accordance with the characteristics of the child. Based on the results of initial observations at TKIT Auladuna, it was found that some children in group B showed

suboptimal fine motor development. This can be seen from the children's difficulty in cutting, drawing neatly, stringing beads, and holding stationery correctly. Based on the results of discussions with class teachers, it was found that the learning activities provided were not specifically aimed at developing fine motor skills systematically. Teachers used more lecture methods and passive activities such as coloring worksheets, which were less challenging in terms of motor skills.

Considering these conditions, an innovative learning model is needed that can be practically implemented by teachers. The STEAM approach, with its flexibility and integration, is one relevant solution. Through STEAM-based activities, children can be involved in activities such as building blocks, making collage artwork, designing cardboard play equipment, and simple experiments using natural materials. These activities require children to actively use their fine motor skills, while providing cognitive challenges that are appropriate to their level of development.

In addition, the STEAM approach also encourages collaboration between children, teachers, and the environment. Teachers are no longer the only source of information, but act as facilitators who provide interesting and meaningful learning stimuli. Children are given the opportunity to explore, try, and make decisions in the learning process. This is in line with the principles of early childhood learning that is child-centered, and pays attention to the individual needs of children.

The importance of this research is also supported by national policies that encourage innovation in early childhood education. The Merdeka Curriculum at the PAUD level prioritizes real-life experience-based learning, which integrates various developmental domains in one activity. The STEAM approach is very much in line with this spirit, because it not only develops cognitive aspects, but also affective and psychomotor aspects of children simultaneously. Furthermore, this approach also encourages the development of life skills from an early age, such as the ability to work together, perseverance, responsibility, and independence (Kemendikbudristek, 2022).

Although many studies abroad have proven the effectiveness of the STEAM approach in early childhood education, in Indonesia, especially in Bengkulu City, there is still very limited research that specifically examines the influence of STEAM-based activities on children's fine motor skills. Therefore, this study is important to provide scientific and practical contributions in developing a more effective and contextual PAUD learning model.

This study aims to determine how much influence STEAM-based activities have on the fine motor skills of group B children at TKIT Auladuna, Bengkulu City. This study does not only focus on the aspect of results (output), but also on the learning process that occurs during the activity. It is hoped that the results of this study can be a reference for PAUD teachers in designing and implementing learning activities that are not only fun, but also have a real impact on child development.

Thus, this study has high urgency and relevance, both academically and practically. Academically, this study enriches the literature on the application of the STEAM approach in the context of early childhood education in Indonesia. Practically, the results of this study are expected to be a reference for teachers, principals, and policy makers in developing learning programs that support the development of children's fine motor skills optimally through integrated, contextual, and fun activities.

LITERATURE REVIEW

1. Early Childhood Education and the Importance of Fine Motor Development

Early Childhood Education (PAUD) is the most basic form of education and greatly determines a child's future. According to Law No. 20 of 2003 concerning the National Education System, PAUD is a development effort aimed at children from birth to the age

of six years which is carried out through the provision of educational stimulation. The goal is to help physical and spiritual growth and development so that children are ready to enter further education. In PAUD, the developmental aspects that are the main focus are physical development (including fine and gross motor skills), cognitive, social-emotional, language, and art. Among these aspects, fine motor development has a very important role in supporting children's readiness to learn at the next level, especially in reading and writing activities (Suyadi, 2017).

Fine motor skills refer to a child's ability to use small muscles in a coordinated manner, such as the fingers and wrists, to perform activities such as writing, drawing, cutting, and stringing (Hurlock, 2002). Fine motor skills are not only important in an academic context, but are also closely related to a child's independence in carrying out daily tasks, such as buttoning clothes, tying shoelaces, or arranging small objects. Therefore, the development of fine motor skills is one of the main priorities in early childhood education.

2. STEAM Concepts and Approaches

STEAM is a development of the STEM (Science, Technology, Engineering, Mathematics) approach with the addition of Art elements in it. Yakman (2008) explains that the STEAM approach integrates five disciplines holistically and contextually, allowing students to think critically, solve problems, innovate, and work collaboratively. The STEAM approach emphasizes project-based learning, experimentation, exploration, and creativity. Art in STEAM is not only related to drawing or painting, but includes all aspects of aesthetics, design, and self-expression. The integration of art in STEAM makes the learning process more enjoyable and meaningful, especially for early childhood who tend to learn through play and direct exploration (Henriksen, 2014).

In the context of PAUD, the STEAM approach is adapted to the characteristics of early childhood development that are concrete and sensorimotor. The activities designed must be based on real experiences, provide space for exploration, develop creativity, and stimulate various aspects of child development, including fine motor skills.

3. The Relationship between STEAM and Children's Fine Motor Development

The STEAM approach has great potential to support the development of children's fine motor skills. In STEAM activities, children are often involved in activities that actively use their hands and fingers, such as: Science: conducting simple experiments such as mixing colors, observing objects using a magnifying glass. Technology: using simple tools or interactive digital media. Engineering: stacking blocks, making constructions from sticks, or assembling simple models. Art: drawing, making collages, shaping clay, folding paper. Mathematics: arranging patterns, counting small objects, classifying objects. All of these activities involve hand-eye coordination, precision, and manipulative skills which are part of fine motor skills (Case-Smith & O'Brien, 2010). Therefore, the STEAM approach not only enriches cognitive and social-emotional aspects, but is also very effective in actively stimulating children's fine motor skills.

Research by Nugroho and Lestari (2021) shows that STEAM-based learning can improve children's fine motor skills through stringing, cutting, painting, and assembling activities. These activities provide fun and meaningful hands-on experiences for children, so that children are more motivated to learn.

4. STEAM Learning in the Context of Early Childhood Education

Implementation of STEAM in early childhood education requires methodological adjustments to suit the characteristics of children's learning. Children aged 4–6 years learn holistically, actively, and based on

play. Therefore, STEAM learning in PAUD must be designed with a thematic approach, project-based, and involving concrete activities. According to Bredekamp & Copple (2009), the principles of effective early childhood learning are learning that is: Active and meaningful; Integrates various developmental domains; Uses the environment as a learning resource; Provides many opportunities for exploratory play;
With these principles, STEAM can be applied in various PAUD activities, such as: Making boats from recycled materials and testing them in water (science and engineering); Drawing geometric shapes (math and art); Arranging blocks according to size and color (math and motor skills); Conducting simple experiments such as making a volcano erupt from soda and vinegar (science); These activities give children space to use their hands, develop creativity, and train thinking skills simultaneously.

5. STEAM-Infused Activities in Local Context

The implementation of STEAM in a local context such as TKIT Auladuna Bengkulu City must consider the culture, resources, and characteristics of students. Teachers need to design activities that are relevant to the surrounding environment, using materials that are easily available and safe for children. Some examples of locally-based STEAM activities include: Making mini stilt houses from bamboo or ice cream sticks (engineering and art); Counting the harvest of fruits from the school garden (mathematics); Observing insects in the garden (science); Drawing natural scenery of Bengkulu (art); Using traditional tools in educational games (local technology); These types of activities not only stimulate fine motor skills, but also instill local cultural values in children from an early age.

6.Previous Research

Many studies have examined the effectiveness of the STEAM approach in early childhood education. Here are some relevant research results: Putri & Wahyuni (2020): Found that the STEAM approach significantly improved fine motor skills and creativity of children aged 5–6 years through activities making props and artwork.
Nugroho & Lestari (2021): Stated that the STEAM approach is effective in improving children's hand and finger coordination through building and assembling activities. Sari et al. (2019): Stated that the project-based STEAM approach encourages children to be more focused, careful, and patient, which are indicators of developing fine motor skills. Choi & Walters (2020): In a study in South Korea, it was found that the STEAM approach increased the motivation and engagement of early childhood in exploratory activities which also strengthened fine motor skills. However, most of these studies were conducted in large urban areas and not many have examined the context of religious schools or institutions such as TKIT that integrate Islamic values in learning. Therefore, it is important to conduct further research in the context of TKIT Auladuna Bengkulu to find out how the implementation of STEAM can be adapted and integrated effectively.

7. Research Gaps and Urgency of Study

Although there has been a lot of research related to the STEAM approach and fine motor skills, there are several gaps that need to be answered through this study: Local Context: There has not been much research exploring the implementation of STEAM in areas such as Bengkulu, especially in TKIT. Integration with Islamic Values: The integration of STEAM with character and spiritual values has not been widely studied. Focus on Fine Motor Skills: Many studies focus more on cognition and creativity, while the fine motor aspect has not been studied in depth in the context of STEAM. Teacher Involvement: There have not been many studies examining the capacity of teachers in designing effective STEAM activities.
By raising this theme, the research attempts to answer this gap, while also providing a real contribution to the development of the

curriculum and learning methods of PAUD in Indonesia.

MATERIALS & METHODS

1. Research Approach and Type

This study uses a quantitative approach with a quasi-experimental research type. Quasi-experiments are chosen because they allow researchers to measure the effect of a treatment in a natural situation without randomizing subjects (non-randomized). This design is considered appropriate for application in early childhood education settings where random allocation of participants is often not possible due to ethical and administrative considerations.

The design used in this study is a pretest-posttest control group design, namely there are two groups (experimental and control) each of which is given a pretest and posttest to measure the development of fine motor skills before and after the treatment is given. The experimental group received treatment in the form of STEAM-based learning activities, while the control group followed conventional learning activities as usually carried out at TKIT Auladuna.

2. Location and Subject of Research

This research was conducted at TKIT Auladuna Bengkulu City, an Islamic-based early childhood education institution under the auspices of a private educational foundation. The selection of the research location was carried out purposively by considering the availability of facilities, teacher readiness in implementing the STEAM approach, and support from the school for research activities.

The subjects in this study were 40 children aged 5–6 years (group B), who were administratively registered as active students at TKIT Auladuna in the even semester of the 2024/2025 academic year. The subjects were divided into two groups with each group consisting of 20 children, namely:

- Experimental group: 20 children who participated in learning activities with the STEAM approach.
- Control group: 20 children who participated in conventional learning activities according to the daily curriculum.

Subject selection was carried out using purposive sampling techniques by considering the balance of age, gender, and initial abilities of children based on the results of the fine motor skills pretest.

3. Research Variables

This research involves two types of variables, namely:

- Independent variable: STEAM-based learning activities.
- Dependent variable: Fine motor skills of children in group B.

The STEAM activities in question include integrated activities from five disciplines (Science, Technology, Engineering, Art, and Mathematics) that are designed thematically and project-based. These activities include, among others: making works from used materials, simple science experiments, building buildings from blocks, painting geometric patterns, and classifying small objects.

4. Research Instruments

Data collection was carried out using a structured observation sheet to assess children's fine motor skills. This assessment sheet was developed based on indicators of fine motor development in children aged 5–6 years in accordance with the Early Childhood Development Guidelines from the Ministry of Education, Culture, Research, and Technology (2022). These indicators include:

- Ability to pinch and pick up small objects
- Accuracy in cutting patterns
- Coloring skills within the lines
- The ability to string together a particular pattern
- Ability to fold and glue paper

The observation sheet has gone through a content validity process by three experts, namely PAUD lecturers, kindergarten teacher practitioners, and child development psychology experts. Validity was declared suitable for use after being revised based on input from experts. To ensure reliability, the instrument was tested on other groups of early childhood outside the research subjects

and analyzed using the Cronbach Alpha formula, with a reliability coefficient of 0.87, indicating a high level of consistency.

5. Research Procedures

The research was carried out in the following stages:

1. **Preparation Stage:**
   - Coordination with the school and class teachers.
   - Preparation of STEAM learning tools for experimental groups.
   - Short training for experimental group teachers on the STEAM approach.
   - Trial of data collection instruments.
2. **Implementation Stage:**
   - The pretest was conducted on both groups using a fine motor skills assessment sheet.
   - For 4 weeks (16 meetings), the experimental group participated in learning activities with the STEAM approach, while the control group participated in conventional learning.
   - Each meeting lasts 60–75 minutes and is conducted face-to-face in the classroom and outdoor space.
3. **Evaluation Stage:**
   - Posttest was conducted at the end of treatment to assess the development of children's fine motor skills.
   - All observation activities were carried out by two trained observers so that the observation results were more objective.

6. Data Analysis Techniques

The data obtained from the pretest and posttest results were analyzed using the Independent Samples t-test with the help of the latest version of SPSS Statistics software. The t-test was used to determine the difference in the average score of fine motor skills between the experimental group and the control group significantly.

Data analysis steps include:

- Test for normality and homogeneity of data to ensure that the parametric test requirements are met.
- Calculation of mean value, standard deviation, and pretest–posttest score difference.
- Hypothesis testing uses an independent t-test at a significance level of 5% ($\alpha = 0.05$).

If the Sig. (2-tailed) value < 0.05, it can be concluded that there is a significant influence of the implementation of STEAM learning on the fine motor skills of group B children at TKIT Auladuna, Bengkulu City.

RESULT

This study aims to determine the effect of STEAM-based activities on the fine motor skills of group B children at TKIT Auladuna, Bengkulu City. The study involved 40 children in Group B who were evenly divided into two groups, namely the experimental group (20 children) and the control group (20 children). Before treatment, both groups were given a pretest to measure initial fine motor skills. Then, the experimental group was given STEAM-based learning activities for eight meetings, while the control group carried out conventional learning without integrating STEAM elements. After treatment, both groups were given a posttest.

The pretest results in the experimental group showed an average value of 17.1 with a minimum value of 14 and a maximum of 21. Meanwhile, the pretest results in the control group showed an average value of 17.6 with a minimum value of 13 and a maximum of 23. Complete data are presented in Table 1 and Table 2.

Table 1 Experimental Group Pretest Data

No.	Child Name	Mark
1.	FA	16
2.	AB	15
3.	AR	18
4.	KH	15

5.	YES	16
6.	RE	21
7.	NA	14
8.	AP	21
9.	VE	16
10.	FE	18
11.	KA	20
12.	PA	15
13.	BI	18
14.	LE	16
15.	MA	18
16	CI	17
17	ZA	16
18	W.S.	18
19	AN	17
20	TO	17
Amount		342
Average		17.1

Table 1 presents the pretest data of children's fine motor skills in the experimental group before being given STEAM-based learning treatment. There were 20 children involved in this group, with individual scores varying between 14 and 21. The lowest score was obtained by a child with the initials NA (14), while the highest scores were achieved by two children, namely RE and AP (each 21). The total overall score was 342, with an average pretest score of 17.1. These results indicate that before the treatment was given, the fine motor skills of children in the experimental group were in the moderate category, and had not shown optimal achievements. These data are the initial basis for seeing the effectiveness of the learning approach that will be applied in improving the fine motor skills of children in group B of Auladuna Kindergarten.

Table 2 Control Group Pretest Data

No.	Child Name	Mark
1.	KI	15
2.	ZE	15
3.	LB	20
4.	QE	15
5.	MI	13
6.	AP	23
7.	DE	18
8.	LS	18
9.	BE	18
10.	AI	21
11.	AU	20
12.	AR	19
13.	AE	18
14.	RA	16
15.	FA	16
16.	IM	15
17.	LI	17
18.	SI	18
19.	ND	16
20.	VI	18
Amount		353
Average		17.6

Descriptively, the initial abilities between the two groups are relatively balanced. This shows that both the experimental and control groups have equivalent fine motor skills before being given treatment. This equality is important so that the posttest results obtained truly reflect the effect of the treatment, not due to differences in initial abilities.

Table 3 Experimental Group Post test Data

No.	Child Name	Mark
1.	FA	21
2.	AB	24
3.	AR	24
4.	KH	26
5.	YES	20
6.	RE	23
7.	NA	18
8.	AP	27
9.	VE	20
10.	FE	25
11.	KA	24
12.	PA	22
13.	BI	25
14.	LE	22
15.	MA	19
16.	CI	24
17.	ZA	22
18.	W.S.	21
19.	AN	21
20.	TO	23
Amount		453
Average		22.67

Table 4 Control Group Post test Data

No.	Child Name	Mark
1.	KI	17
2.	ZE	16
3.	LB	20
4.	QE	17
5.	MI	15
6.	AP	24
7.	DE	21
8.	LS	18
9.	BE	21
10.	AI	22
11.	AU	22
12.	AR	19
13.	AE	20
14.	RA	17
15.	FA	15
16.	IM	20
17.	LI	18
18.	SI	22
19.	ND	16
20.	VI	19
Amount		378
Average		18.93

The comparison of the average and minimum–maximum values of the two groups is presented in Table 3 below:

Table 5 Description of Minimum and Maximum Pretest and Post test Values Experimental and Control Groups

	N	Minimum	Maximum	Sum	Mean	Std. Deviation
Experimental class pretest	20	14	21	257	17.13	2.232
Posttest of experimental class	20	18	27	340	22.67	2,664
Pretest control class	20	13	23	265	17.67	2,690
Posttest control class	20	15	24	284	18.93	2,764
Valid N (listwise)	20					

Treatment of Experimental and Control Groups

After the pretest, the researcher gave treatment to both groups. The experimental group received treatment in the form of learning using loose parts media, while the control group was given learning using block media. Learning in the experimental group was carried out six times with various exploratory activities based on loose parts, such as arranging animal shapes, plants, number symbols, and the residential environment. The learning process was designed to encourage children's ability to recognize colors, numbers, sizes, and grouping and sequencing. Children were actively involved in discussing materials, developing ideas, and reflecting on their work verbally.

In contrast, in the control group, children played using block media with similar activities in terms of exploring color, shape, and size, but with a more limited level of variation and flexibility of materials compared to loose parts. Although the learning process was interesting, block media had limitations in stimulating children's creativity and flexibility of exploration compared to loose parts.

Posttest Results of Experimental Group and Control Group

After the treatment process was completed, a posttest was conducted to measure changes in children's cognitive abilities in each group. The posttest results showed an increase in scores in both groups, but a higher increase occurred in the experimental group. The average posttest for the experimental group was 22.67 with a maximum score of 27 and a minimum of 18, while in the control group the average was 18.93 with a maximum score of 24 and a minimum of 15. This shows a significant difference in improvement between the two groups.

The increase in scores from pretest to posttest in the experimental group was 5.54 points (22.67 - 17.13), while the increase in the control group was only 1.26 points (18.93 - 17.67). The normality test was conducted to determine whether the pretest and posttest data in both groups were normally distributed or not. The test used was the Shapiro-Wilk test with the help of SPSS 16 software. Based on the test results, the following significance values were obtained: The findings of this study indicate that STEAM-based learning significantly improves the fine motor skills of early childhood. STEAM activities allow children to engage in various exploratory activities such as mixing colors, arranging objects, arranging patterns, drawing, cutting, and sticking, all of which stimulate the development of fine hand muscles and eye-hand coordination.

The improvement in fine motor skills in the experimental group shows the effectiveness of the STEAM approach in providing a richer and more meaningful learning experience. This is in line with research by Yakman & Lee (2018) which states that STEAM learning encourages motor, cognitive, and social skills simultaneously through project-based and collaborative activities. Meanwhile, the control group that was not given STEAM-based learning showed lower improvements. This suggests that conventional approaches tend to be less challenging and do not involve many manipulative activities that contribute to children's fine motor development.

Thus, STEAM-based activities have been empirically proven to have a positive and significant effect on the fine motor skills of

group B children at Auladuna Kindergarten, Bengkulu City, and can be recommended as an innovative learning approach in Kindergartens.

Data Analysis

Before conducting hypothesis testing, the first steps involve performing normality and homogeneity tests on the pretest and posttest data as part of the data analysis process.

a. Normality Test

The normality test aims to determine whether the obtained data follows a normal distribution. To test normality, the Shapiro-Wilk (W test) is used with the help of SPSS 16 software. The decision rule for the Shapiro-Wilk test is as follows: if the significance (sig) value is greater than 0.05, the data is considered to be normally distributed. Conversely, if the significance (sig) value is less than 0.05, the data is considered not to be normally distributed.

Table 6 Results of Normality Test for Experimental and Control Groups

Kelas		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Result fine motor skill	Pre-Test Eksperimen	.228	15	.035	.902	15	.104
	Post-Test Eksperimen	.158	15	.200*	.968	15	.825
	Pre-Test Kontrol	.149	15	.200*	.968	15	.822
	Post-Test Kontrol	.158	15	.200*	.952	15	.557

b. Homogeneity Test

After confirming that the data is normally distributed, the next step is to conduct a homogeneity test to determine whether the two groups (experimental and control) have similar characteristics. The Levene's test is used for this purpose, also with the aid of SPSS 16 software. If the significance (sig) value is greater than 0.05, the data from both groups is considered homogeneous.

Based on Table 7, the calculated significance (sig) value of 0.815, which is greater than 0.05, indicates that the data comes from homogeneous groups with similar characteristics.

Table 7 Results of Homogeneity Test for Experimental and Control Groups

		Levene Statistic	df1	df2	Sig.
Fine Motor skill result	Based on Mean	.056	1	28	.815
	Based on Median	.069	1	28	.794
	Based on Median and with adjusted df	.069	1	27.909	.794
	Based on trimmed mean	.061	1	28	.806

c. Hypothesis Test

After confirming that the data is normally distributed and homogeneous, hypothesis testing is conducted using an independent sample t-test to determine if there is a significant difference between the two unpaired groups: the experimental and the control groups. This test is used to examine the difference in fine motor skills between children who were given treatment using STEAM and those who were not.

The results of the independent sample t-test show a significance (sig) value of 0.001, which is less than 0.05, meaning that the null hypothesis (Ho) is rejected, and the alternative hypothesis (Ha) is accepted. Therefore, it can be concluded that there is a significant difference in fine motor skills between children who received the STEAM treatment and those who did not, among the B group children at Auladuna Kindergarten, Bengkulu City.

Table 8 Result of Hypothesis Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Result fine motor skill	Equal variances assumed	.056	.815	3.767	28	.001	3.733	.991	1.703	5.763
	Equal variances not assumed			3.767	27.962	.001	3.733	.991	1.703	5.764

CONCLUSION

Based on the results of the study, it can be concluded that STEAM-based learning activities have an effect on improving the fine motor skills of group B children at TKIT Auladuna, Bengkulu City. This approach has been proven to be able to encourage children to be actively involved in activities that require hand-eye coordination, precision, and finger muscle strength through exploration of various materials and activities that are integrated with elements of science, technology, engineering, art, and mathematics. This finding is new because it shows that the STEAM approach is not only relevant to be applied at elementary and secondary education levels, but is also effective in supporting aspects of early childhood physical development, especially fine motor skills. This study recommends that PAUD teachers begin to integrate the STEAM approach into daily learning activities. In addition, further research can examine the application of STEAM

Declaration by Authors

Acknowledgement: None
Source of Funding: None
Conflict of Interest: No conflicts of interest declared.

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How to cite this article: Dwi Lyna Sari, Dwi Ismawati, Lazfihma, Meli Afrodita. The influence of STEAM-Containing activities on fine motor skills of group B children at Auladuna Kindergarten, Bengkulu City. *International Journal of Research and Review*. 2025; 12(6): 691-703. DOI: *10.52403/ijrr.20250678*

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