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Enhancing Fine Motor Skills in Early Childhood Through Fun Cooking Activities: A Quasi-Experimental Study in Purwakarta, Indonesia

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Keywords:

Inquiry Early Childhood Education, Fine Motor Skills, Development, Fun Cooking Activities, Quasi-Experimental Study.

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Received 12 08 2023
Revised 25 11 2023
Accepted 12 12 2023
Published Online First
30 12 2023



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Abstract

This quasi-experimental study investigates the impact of engaging in cooking activities on fine motor skill development in kindergarten children aged 4-5 in Purwakarta, Jawa Barat, Indonesia. Adopting a Nonequivalent Control Group Design, the research compared two groups: an experimental group participating in fun cooking activities and a control group following traditional teaching methods. Pretest and posttest assessments were conducted using a rating scale-based observation tool to measure fine motor skills. The intervention comprised three sessions of cooking activities, focusing on enhancing fine motor abilities. Data analysis utilized the N-Gain score method to quantify skill improvements. Results revealed a medium N-Gain score in the experimental group, indicating a significant enhancement in fine motor skills due to the cooking activities. In contrast, the control group showed no significant change. These findings suggest that fun cooking activities effectively develop fine motor skills in early childhood, offering a practical and engaging alternative to conventional teaching methods. This study's implications extend to curriculum design in early childhood education, advocating for integrating diverse and interactive activities. However, its limited geographical scope and the short duration of the intervention point to the need for further research. Future studies should explore long-term effects and broader applicability, potentially impacting policies and practices in early childhood education. This research adds to the growing body of literature that supports innovative and engaging learning approaches in the foundational years of schooling.

To cite: Maranatha. J. R., Briliany. M., (2023). Enhancing Fine Motor Skills in Early Childhood Through Fun Cooking Activities: A Quasi-Experimental Study in Purwakarta, Indonesia. *Golden Age: Jurnal Ilmiah Tumbuh Kembang Anak Usia Dini*, 8(3), 203-212. <https://doi.org/10.14421/jga.2023.84-01>

Introduction

Developing fine motor skills in early childhood is critical to holistic development, influencing a child's academic and practical abilities throughout life. It is essential in the context of individual growth and holds significant implications for broader societal and educational frameworks. Despite advancements in pedagogical approaches, it remains challenging to effectively nurture these skills in young children, particularly in diverse educational settings (Bolger et al., 2021; Jirout et al., 2019). This issue is not merely a concern within the domain of education but extends to encompass the overall well-being and future potential of individuals in society. Addressing the gap in effective, acceptable motor skill development methods is a matter of educational importance and societal urgency.

Research has highlighted the intricate relationship between fine motor skills and various developmental aspects in children. Telford et al. (2022) noted improved fine motor control through physical literacy interventions in childcare settings. Gashaj and Trninic (2023) observed a complex interplay between fine motor skills and mathematical abilities, indicating the variable nature of this relationship across different ages. Faber et al. (2024) revealed age-related qualitative differences in acceptable motor skill performance, underscoring the evolving nature

of these skills in early childhood. Willoughby and Hudson, (2023) emphasized the stronger association of motor skill development with executive function skills over the intensity of physical activity.

Fine motor skill development has been the subject of extensive research, leading to the discovery of additional dimensions. Asakawa and Sugimura (2022) explored the relationship between preschoolers' fine motor skills and early mathematical abilities. Their study revealed a significant correlation between fine motor skills, finger gnosis (recognizing and differentiating one's fingers), and early calculation abilities. This finding underscores the importance of fine motor skill development in early childhood education, particularly about foundational mathematical skills.

Separately, Malone et al. (2022) focused on identifying the predictors of academic achievement. Their research highlighted domain-specific skills more indicative of future academic success than general fine motor skills or executive functions. This insight shifts the focus towards developing specialized skills in early education. In a different vein, Suggate et al. (2023) investigated the benefits of typing over traditional writing for children with impaired fine motor skills. Their results supported the efficacy of typing as a viable alternative. However, Martzog and Suggate (2022) pointed out a concerning trend: the negative impact of increased screen media usage on fine motor skill development, particularly with the advent of new media forms. This finding raises important questions about the balance between technological integration in education and preserving essential developmental skills.

The educational context also plays a crucial role in developing these skills. Bossavit and Arnedillo-Sánchez (2023) highlighted the potential of motion-based technology in the early detection and screening of motor skill development. Krombholz (2023) observed differences in motor milestone achievement between firstborn and later-born children. Chandler et al. (2021) and Fuschlberger et al. (2024) provided insights into the stability of developmental milestones and the influence of self-regulation on the relationship between fine motor skills and writing. Chui Betancur et al., (2023) emphasized enhancing psychomotor skills through play activities.

Fine motor skills involve controlling small muscles, particularly in the hands and wrists, to execute detailed movements (Formiga & Linhares, 2015). These skills, critical for a child's development, influence their flexibility, social adjustment, and academic performance. Fine motor development requires precise hand-eye coordination and not necessarily high energy. These skills can be enhanced through creative activities like drawing, coloring, weaving, sticking, cutting, etc (Wang et al., 2023). These activities, aligning with the concept of education in early childhood, not only foster creativity but also strengthen hand muscles. For instance, weaving requires high accuracy and hand capability, while activities like sticking and cutting are often associated with early learning and cooking activities, respectively (Zhang et al., 2024).

However, observations in a kindergarten class in Purwakarta and interviews with teachers reveal several issues hindering early childhood development of fine motor skills. Factors such as weak hand-eye coordination and parents' and teachers' neglect of skill development have been identified. Teachers often fail to utilize varied and innovative media to engage children, resulting in suboptimal development of these skills. Therefore, there is a need for innovative methods and media in teaching to develop and train early childhood fine motor skills better. One such innovation is "fun cooking," combining enjoyment with cooking activities. This approach allows children to engage directly in food preparation processes like holding, cutting, and processing ingredients, enhancing their fine motor skills in an engaging and hands-on manner (Başar & Elyildirim, 2021; Strouse et al., 2019).

According to Anggraheni (2019) the benefits of cooking class activities include being able to introduce food ingredients, nutritional content, and their benefits for early childhood growth and development, and to practice children's fine motor skills, and developing early childhood creativity through decorating serving plates according to children's creations. Another advantage of engaging in early childhood cooking is developing several knowledge structures, including physical, logical, and social as described (Anderson et al., 2019; Budiarti, 2021). Early

childhood can enhance physical knowledge by touching foodstuffs such as hard, soft, smooth, etc. (Habibi, 2022). Moreover, the young children who cooked revealed immediate advantages and emotional effects and showed more interest in cooking at home after the cooking program; recommended that a cooking program can have a good effect on the young children in the time of the meal and extend over the longer term (Dean et al., 2021).

Recent studies have also examined the broader implications of motor skill development. Thomas et al. (2023) identified associations between cognitive flexibility and specific brain network connectivity patterns. Palmer et al. (2021) and Kasanen et al. (2023) discussed the significance of fundamental movement skills in predicting physical activity engagement and reducing sedentary behavior. Cortez Ferreira et al. (2023) linked early-onset fetal growth restriction in preterm infants to poorer neurodevelopmental outcomes, particularly motor skills.

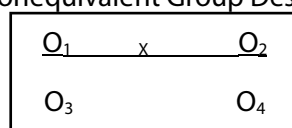
Despite these extensive studies, there remain limitations and gaps in the current understanding and practical application of fine motor skill development. Many of these studies have not explored alternative, innovative methods that could offer more effective ways of enhancing these skills in early childhood. Furthermore, a lack of research focuses on integrating enjoyable, everyday activities like cooking into educational curricula to improve fine motor skills. This gap in research and practice underscores the need for novel approaches in early childhood education and intervention strategies (Hanafiah et al., 2023; Maurer & Roebbers, 2020).

The focus of this study is to evaluate the effectiveness of a novel intervention – engaging in enjoyable cooking activities – on the development of fine motor skills in kindergarten students aged 4-5 in Purwakarta, Jawa Barat, Indonesia. This research aims to provide empirical evidence on the comparative effectiveness of this method against traditional approaches. The study holds the potential for significant contributions to early childhood education by offering insights into alternative pedagogical strategies that can enhance fine motor skill development, thereby influencing the broader trajectory of children's academic and practical skill development.

Methods

This study employed a quasi-experimental design, specifically the Nonequivalent Control Group Design, to investigate the effectiveness of a fun cooking method in improving early fine motor skills in kindergarten students. In this approach, two classes from a kindergarten in Purwakarta-Jawa Barat, Indonesia, were selected: one experimental class and one control class, each comprising 13 students aged 4-5 years. The courses were not chosen randomly. The design involved conducting pretests (O1 and O3) and posttests (O2 and O4) in both the control and experimental groups to assess the initial state and measure the impact of the intervention (Creswell & Guetterman, 2019).

Nonequivalent Group Design



Description:

O1 and O3: pretest on the control class and the experimental class

O2 and O4: posttest on control class and experimental group

X: Treatment of the experimental class

The intervention involved a fun cooking activity designed to enhance fine motor skills. The experimental group received this treatment (denoted as 'X' in the study design), while the control group received no specific intervention. Both groups were subjected to pretest and posttest assessments to evaluate changes in their fine motor skills.

The primary research instrument was a rating scale-based observation sheet. This scale facilitated the quantitative assessment of students' fine motor skills, allowing for the conversion of observed behaviors into numerical data, which were then used for analysis (Dyevre & Ovádek, 2020). Data were collected using the rating above scale. The study focused on measuring the

normalized gain (N-Gain) in fine motor skills from the pretest to the posttest. N-Gain scores were calculated to determine the effectiveness of the fun cooking method, comparing the improvement in fine motor skills between the experimental and control groups.

Standardized procedures were followed in data collection and analysis to ensure the study's reliability and validity. Using a rating scale provided a consistent method for evaluating fine motor skills, and the N-Gain analysis offered a robust framework for comparing improvements between groups. Furthermore, the quasi-experimental design, with its pretest and posttest measures, contributed to the validity of the findings by establishing a baseline and measuring changes over time.

Result

The process begins with a pre-test in the experimental class and control class. Then, the practical type was treated three times, while the control class continued to use conventional methods. After the treatment, a posttest was followed on the experimental and control types.

The experimental class was given treatment using the fun cooking learning method. In contrast, the control group was not assigned any therapy, meaning they continued using the learning the teacher usually used. The difference in treatment between the two groups was intended to determine its effect on student learning outcomes. After learning, a final observation was held in each sample class. The reason for choosing an experiment to assess the impact of the fun cooking program on motor development must be early childhood. The pretest and posttest data are presented in Table 1.

Table 1. Recapitulation of Pretest and Posttest Results

	Experimental Class		Control Class	
	Pre Test	Post Test	Pre Test	Post Test
Total Number Of Students	13	13	13	13
Mean	47,1	57,6	21,6	24,3
N Gain Score	0,5		0,0	

$$N\ GAIN = \frac{\text{Score Post-Test} - \text{Score Pre-Test}}{\text{Score Ideal} - \text{Score Pre Test}}$$

The calculation of N Gain, a measure used in educational research to assess the effectiveness of teaching methods or interventions, involves several steps. First, establish the ideal score, typically a fixed value, such as 66. Then, calculate the difference between each individual's post-test and pre-test scores. Next, subtract this difference from the ideal score for each data point. After performing this operation for each individual, calculate the average of these values across the entire dataset. Finally, the N Gain is determined by dividing the standard of the ideal scores by the average of these differences, reduced by the differences between the post-test and pre-test scores. This formula provides a standardized measure of the relative improvement in knowledge or skills as a result of the educational intervention being assessed.

N-GAIN DIVISION	
N-GAIN VALUE	CATEGORIES
$g > 0,7$	HIGH
$0,3 < g < 0.7$	MEDIUM
$g < 0,3$	SMALL

(Anderson et al., 2019)

Based on the results obtained from the experimental class, 0,5 is in the medium category, while the N Gain Score obtained from the control group is 0,0, so it can be accepted. There is a significant difference between the experimental and control classes, meaning the improvement of fine motor skills in young children with the fun cooking method.

Furthermore, no significant negative results were observed in this study. The control class also showed improvement using conventional methods, albeit not as markedly as the

experimental class. This suggests that conventional methods still have specific benefits in developing fine motor skills, though they are less effective than enjoyable cooking methods.

The participants' reaction to the enjoyable cooking method was generally positive. Students exhibited tremendous enthusiasm and joy during the learning process, which likely contributed to their improved scores. On the other hand, no significant adverse reactions were reported from the control class.

Finally, a surprising and intriguing outcome of this study is the significant difference in improving fine motor skills between the experimental and control classes. This underscores the importance of innovative and engaging learning methods for young children's skill development. Overall, the results of this study demonstrate that the enjoyable cooking method is effective in enhancing the fine motor skills of young children compared to conventional methods, providing significant implications for educational practices at the preschool level.

Discussion

The current study aimed to evaluate the impact of fun cooking activities on fine motor skills development in kindergarten children, contrasting traditional methods. This approach aligns with the broader research trend emphasizing the importance of engaging and interactive methods in early childhood education. Focusing on fine motor skills is particularly pertinent, considering their critical role in a child's development and learning capabilities. Prior research has highlighted the significance of developing these skills early, with various approaches yielding differing results. Our study contributes to this ongoing discourse by providing empirical evidence from a controlled experimental setting.

Our findings revealed a notable improvement in the fine motor skills of children who participated in the fun cooking activities compared to those who followed traditional methods. The experimental group demonstrated a medium N Gain score of 0.5, indicating significant progress. This result is particularly striking, considering the control group showed no improvement, as evidenced by an N Gain score of 0.0. These observations are not only exciting but also highlight the effectiveness of the fun cooking method in enhancing fine motor skills in young children, thus underscoring the potential of innovative teaching methods in early education (citation needed).

Based on the N-Gain score, it can be identified that children who got the fun cooking program intervention had better fine motor skills than children who got the conventional method. This research's findings align with past research conducted by Kania, who found that fun cooking learning can increase children's enthusiasm for learning and improve children's fine motor skills (Kania et al., 2022). This result also follows the study conducted by Agustina, which shows that a fun cooking program can be implemented through project learning techniques that boost fine motor skills and creativity (Agustina, 2021). Cooking programs provide multi-sensory experiences as early childhoods use their five senses to touch, smell, taste, see, and hear food. Furthermore, there are more advantages of involving early childhood in cooking, including developing fine motor skills and socio-emotional capabilities, for example, confidence (Kania et al., 2022; Rasid et al., 2020).

Integrating fun cooking activities into educational settings presents a compelling opportunity to optimize learning experiences for children. This approach aligns with the need to create engaging and enjoyable atmospheres, fostering an environment where learning is informative and highly anticipated by students. As educators, it is crucial to tailor these cooking activities to match the developmental stages of the children, ensuring that the activities are stimulating and appropriate. This method is particularly effective in enhancing fine motor skills, a critical aspect of early childhood development. Children naturally inclined to imitate and experiment benefit significantly from guided activities that allow room for exploration. The objective is to design learning experiences that are fun, clear, and with well-defined goals, enabling children to engage effectively with the learning process and achieve the set educational objectives. Empirical evidence supports this approach; a study by Laela & Citra

Novita, (2022) found that using healthy cooking video media significantly improved learning outcomes compared to traditional methods.

The preliminary findings from implementing fun cooking programs in kindergarten indicate a positive influence on children's fine motor skills. However, the research also highlights the need for further investigation to identify the most effective practices within these programs. Several aspects remain unclear, such as the ideal setting for these programs (schools, community centers, or homes), the optimal frequency of exposure, and the potential role of nutrition education within cooking activities. Addressing these gaps requires comprehensive research, encompassing both controlled trials and qualitative assessments, to understand the full impact of these programs. Future studies should aim to explore these variables in various environments to provide a more detailed understanding of how fun cooking activities can be best utilized in early childhood education. The ultimate goal is to seamlessly integrate these activities into the daily routines of young learners, thereby enriching their educational experience and developmental progress.

Comparing our results with previous studies, there are both alignments and contrasts. For instance, Telford et al. (2022) found improvements in specific delicate motor control tasks through physical literacy interventions, similar to our findings. Gashaj et al. (2019) and Faber et al., (2024) reported more nuanced relationships between motor skills and other developmental areas, suggesting a more complex interaction than observed in our study. Our results also align with Willoughby & Hudson (2023) assertion of the strong association between motor skills and executive functions, underscoring the multifaceted nature of early childhood development.

The observed improvements in fine motor skills within the experimental group can be attributed to the engaging nature of the fun cooking activities. These activities likely provided the children with a more stimulating hands-on learning experience conducive to developing fine motor skills. As supported by Asakawa & Sugimura, (2022), such activities can enhance specific abilities like counting and symbolic comparison, which are closely linked to fine motor skills. Additionally, the structure and variety of tasks involved in cooking could have contributed to better skill acquisition than traditional methods.

Moreover, the findings suggest that the fun cooking method could address gaps in motor skill development not typically fulfilled by conventional teaching methods. For example, Suggate et al., (2023) found that children with impaired motor skills benefited more from typing than writing, indicating the need for alternative learning methods. Similarly, our study's fun cooking approach may offer a more inclusive and effective means of developing motor skills, particularly for children who might not respond as well to traditional methods.

However, caution should be exercised in interpreting these results. While the improvements in the experimental group are significant, they are context-specific and may not be universally replicable. Factors such as the individual differences among children, the quality of implementation, and the environmental context could influence the effectiveness of such interventions. Furthermore, longitudinal studies are needed to determine the long-term impact of such interventions on motor skill development and academic achievements.

The implications of our study are multifaceted. Firstly, it provides practical evidence supporting integrating innovative and engaging methods like fun cooking in early childhood education curricula. This aligns with findings from Stevens et al. (2023) and Matafwali & Mofu (2023), who emphasize the benefits of diverse and interactive learning experiences. Secondly, it underscores the need for educators to consider alternative and varied teaching methods to cater to the developmental needs of all children. Finally, this study contributes to the growing body of literature advocating for a more holistic and engaging approach to early childhood education, potentially influencing policy and practice in this field.

Conclusion

This study's primary objective was to evaluate the impact of enjoyable cooking activities on the development of fine motor skills in kindergarten students aged 4-5 in Purwakarta, Jawa Barat,

Indonesia, comparing these activities with traditional teaching methods. The research revealed a notable enhancement in fine motor skills among children in the experimental group who engaged in fun cooking activities, in contrast to the control group that continued with conventional educational approaches. This finding underscores the value of incorporating creative and engaging methods in early childhood education to foster essential developmental skills. It highlights the need for educational systems to embrace more diverse and interactive teaching techniques, catering to the varied developmental needs of young children. However, the study is not without its limitations. The restricted geographical scope to a single location limits the broader applicability of the findings. Additionally, the limited duration of the intervention period raises questions about the long-term effects and sustainability of the observed improvements in fine motor skills. Therefore, it is recommended that further research be conducted, encompassing a more extensive demographic and a more extended intervention period. Such studies could provide deeper insights into the long-term efficacy of fun cooking activities and their potential broader impacts on other developmental domains, including cognitive and socio-emotional growth in early childhood. This could significantly contribute to the evolving practices in early childhood education, ensuring a well-rounded and engaging learning environment for young learners.

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