

# Analysis of STEAM-Based Learning through “Fruit Skewers” Fun Cooking Activities for Early Childhood

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**Abstract:** This study aims to analyze the implementation of the STEAM (Science, Technology, Engineering, Art, and Mathematics) approach in the “Fruit Skewer” fun cooking activity and its impact on early childhood development at TK Aisyah Islamic Preschool. A descriptive qualitative method with a case study approach was employed. Data were collected through participatory observation, semi-structured interviews, and documentation. The results show that all five STEAM components can be effectively integrated into a single contextual and enjoyable learning activity. Science was reflected in the exploration of fruit types, tastes, textures, and benefits; technology through the use of simple cooking tools; engineering through the stages of assembling the fruit skewers; art through aesthetically arranging the fruit pieces; and mathematics through activities such as counting, classifying, and patterning. This activity had a positive impact on various aspects of children’s development, including cognitive, language, fine motor, social-emotional, creativity, and character. STEAM-based learning through fun cooking not only increased children’s interest and engagement but also fostered 21st-century skills holistically. This study recommends similar activities as innovative learning strategies that are relevant for implementation in early childhood education settings.

**Keywords:** Early Childhood; Fun Cooking; Fruit Skewers; STEAM

## Introduction

State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results. Early Childhood Education (ECE) is a critical stage in building the foundational development of children in a comprehensive manner. It plays a pivotal role in children’s growth and development, encompassing not only cognitive but also emotional and social development (Rodiah et al., 2024). This stage is often referred to as the “golden age,” where appropriate stimulation greatly influences children’s growth and learning (Rohmadi et al., 2020; Scarlett et al., 2005; Untung et al., 2023). According to the Indonesian Ministry of Education and Culture Regulation No. 5 of

2022, the aspects of child development that must be stimulated include religious and moral values, Pancasila values, physical-motor, cognitive, language, and social-emotional development. Therefore, learning approaches in ECE should be designed to be holistic and enjoyable so that children can learn actively and meaningfully.

One such holistic and enjoyable learning approach that is currently trending and gaining research attention in the education field is the STEAM approach (Science, Technology, Engineering, Art, and Mathematics) (Supriyadi et al., 2023). STEAM integrates science, technology, engineering, art, and mathematics into a new educational methodology, serving as a pedagogical alternative that offers a more holistic and engaging learning experience (Marín-Marín et al., 2021). STEAM practices can foster creativity and thinking skills by

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connecting disciplines through a transdisciplinary learning approach (El Bedewy & Zsolt, 2023). Numerous studies have explored its implementation and impact in education, emphasizing its role in developing key 21st-century skills (Firmansyah & Aslan, 2025; Mariano & Chiappe, 2021; Papadopoulou, 2024). Thus, the STEAM approach is a holistic and enjoyable learning method that integrates various disciplines while nurturing creativity, thinking skills, and 21st-century competencies.

Many studies have focused specifically on the application of the STEAM approach in early childhood education (Nhi et al., 2024; Su et al., 2025). Recent research highlights the integration of STEAM in early childhood education, emphasizing its role in promoting holistic development. Various articles discuss pedagogical methods, implementation challenges, and the impact of STEAM on child development. The STEAM approach in early childhood focuses on developing critical and creative thinking skills by integrating science, technology, engineering, art, and mathematics (Huda et al., 2024). It provides opportunities to stimulate all aspects of early childhood development in preparation for facing the challenges of the Society 5.0 era (Jaya et al., 2025). This approach encourages children to develop ideas based on science and technology through active engagement in problem solving activities that holistically integrate the five disciplines (Motimona & Maryatun, 2023). Through STEAM learning, young children can sharpen their critical thinking, foster creativity, and build independence by engaging in exploration and problem solving activities (Hanifah & Kurniati, 2024). STEAM-based learning continues to gain research attention due to its potential in supporting holistic child development through the integration of five disciplines. It not only develops critical and creative thinking skills but also stimulates comprehensive development to prepare children for the challenges of the 21st century and Society 5.0.

Fun cooking activities, such as making fruit skewers, serve as effective learning media to implement STEAM content. Fun cooking is a simple and enjoyable cooking activity tailored to the characteristics of young children, designed to stimulate their development particularly in cognitive aspects related to thinking and reasoning, as well as social-emotional aspects involving behavior and adaptability (Amania et al., 2021). It can stimulate early childhood creativity (Maharani, 2023). Fun cooking is an innovative and promising approach in early childhood education as it offers a joyful and meaningful learning experience while supporting holistic child development (Budiarti, 2025). Through fun cooking activities, children can learn to identify different

types of fruit (science), understand step by step instructions and simple tools (technology and engineering), arrange fruit creatively (art), and count the fruit pieces (mathematics). Additionally, these activities train fine motor coordination, teamwork, and communication skills.

TK Aisyah Islamic Preschool, as an institution that promotes active and contextual learning, has integrated fun cooking activities into its curriculum. However, an in depth analysis is still needed to assess how effectively these activities incorporate STEAM elements and their impact on child development.

Based on the description above, this study was conducted to analyze STEAM-based learning through the "fruit skewer" fun cooking activity for early childhood at TK Aisyah Islamic Preschool. It is expected that this research can contribute to the development of innovative and enjoyable STEAM-based learning models in early childhood education.

## Method

Research design and method should be clearly defined. This study employed a descriptive qualitative approach with a case study design. The descriptive qualitative method aims to understand a phenomenon or event in depth, either through direct or indirect involvement. Data collection was conducted gradually and continuously, not just in a single instance, allowing the researcher to construct a descriptive or narrative picture of the entire research process from beginning to end (Yusuf, 2014). This approach was chosen to describe and analyze in depth the STEAM-based early childhood learning process through the 'fruit skewer' fun cooking activity at TK Aisyah Islamic Preschool.

The research was conducted at TK Aisyah Islamic Preschool, located in Sungai Penuh City. The subjects of the study were group B children, one class teacher, and the school principal as supporting informants.

Data were collected using several techniques: participant observation, in which the researcher directly observed the fun cooking 'fruit skewer' learning activity in the classroom to examine children's engagement in STEAM aspects; semi structured interviews, conducted with the class teacher and principal to obtain information regarding the planning, implementation, and evaluation of the fun cooking activity; and documentation, including photos of the activity, Daily Lesson Plans (RPPH), and child development records.

Data analysis was carried out through the following qualitative stages: 1) Data collection; 2) Data reduction, filtering information relevant to the research focus, namely children's activities that reflect STEAM elements in the fun cooking activity; 3) Data presentation,

organizing data into descriptive narratives, tables, and photos; 4) Conclusion drawing, identifying emerging patterns and their relation to the STEAM approach in the observed activity. The process follows the model illustrated by Figure 1.

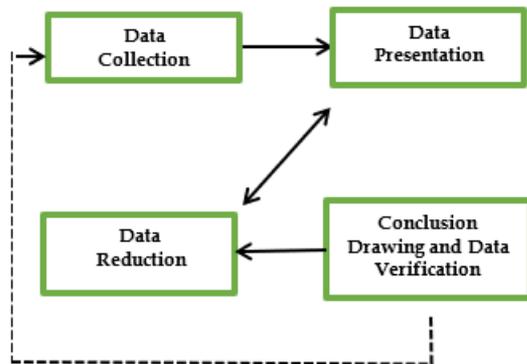


Figure 1. Qualitative Data Analysis Flow (Miles et al., 2014)

**Result and Discussion**

Results should be clear and concise. The discussion should explore the significance of the results of the work, not repeat them. A combined Results and Discussion section is often appropriate. Avoid extensive citations and discussion of published literature. The 'fruit skewer' fun cooking activity was conducted in Class B at TK Aisyah Islamic Preschool. This activity was part of the sub-theme 'I Like Fruits' and was designed using a project-based learning model that integrated STEAM components. Children were guided to prepare fruit pieces, assemble them onto skewers, and decorate them creatively. The activity lasted 90 minutes with the support of the class teacher and assistant teacher.

The activity began with an introduction about the importance of eating fruits, followed by a teacher demonstration, and then the children performed the activity independently in small groups. Throughout the process, the teacher observed and documented the children's engagement. The integration of STEAM components in the 'fruit skewer' fun cooking activity is shown in the Table 1.

**Table 1.** STEAM Component Analysis in the Fun Cooking Activity 'Fruit Skewers'

STEAM Component	Observed Indicators	Children's Activities	Remarks
Science	a) Identifying fruit types b) Understanding taste, color, and texture c) Learning how fruits grow and are cared for d) Recognizing fruit plant shapes e) Understanding nutrition and benefits	a) Naming fruits: banana, watermelon, melon, grapes, etc. b) Differentiating sweet/sour tastes, colors, and textures c) Answering questions like "Where does this fruit grow?", "How do we care for it?" d) Discussing benefits of eating fruits	Children engaged in multi-sensory exploration, environmental knowledge, and nutrition learning in a fun and contextual way
Technology	a) Using simple cooking tools b) Recognizing functions of kitchen utensils	a) Using plastic knives, skewers, cutting boards, forks, spoons, plates, bowls b) Placing fruits in appropriate containers c) Using tools correctly and carefully	Children learned about safe kitchen tools and understood their purpose
Engineering	a) Designing and understanding steps in skewer-making b) Recognizing stages of processing materials c) Solving simple problems while assembling fruits	a) Washing fruits b) Cutting fruits with teacher assistance c) Arranging fruits on skewers based on color, size, or type d) Fixing skewers if fruits fall or are misplaced	Children demonstrated understanding of workflows, problem-solving skills, and systematic, logical thinking
Art	a) Arranging fruits aesthetically b) Decorating food with attractive colors and shapes	a) Choosing fruit color combinations b) Arranging fruits creatively c) Showing pride in their creations	Enhanced appreciation of beauty, imagination, and self-expression
Mathematics	a) Recognizing fruit shapes and sizes b) Counting and classifying fruits c) Creating patterns and sequences	a) Identifying shapes: round, oval, long b) Comparing sizes: big/small c) Grouping fruits by color or type d) Counting fruit pieces e) Making AB-AB and ABC-ABC skewer patterns	Children developed number concepts, geometry, patterns, and logical reasoning through playful and creative activities

### Science Component in the Fun Cooking Activity "Fruit Skewers"

The Science component in the fun cooking activity "Fruit Skewers" is prominently observed in various aspects of the children's activities. This activity serves as an exploratory medium that allows children to use their senses to observe, recognize, and understand the various characteristics of fruits and the natural processes related to fruit plants.



**Figure 2.** Types of Fruits, Ingredients, and Tools Used in Making Fruit Skewers

In this activity, children were introduced to a variety of fruits, as illustrated in the dialogue between the teacher and the children below:

Teacher: "Today we are going to make fruit skewers. Let's first take a look at the fruits we have. Who can name these fruits?"

Child A: "That's a banana, Miss!"

Child B: "That one is a pear, Miss!"

Child C: "I know that the pink one is an apple, Miss!"

Child D: "Miss, this is a grape!"

Teacher: "Wow, great! You got them all right. We have bananas, apples, pears, and grapes. Has anyone ever eaten all of them?"

Child A: "I like grapes because they taste sweet!"

Child B: "I like bananas because they're soft."

Teacher: "Can you tell which fruit is red, purple, and which is yellow?"

Child C: "The apple is pinkish-red, the banana is yellow!"

Child D: "The grape is purple, and the pear is yellow!"

Teacher: "Good! Now try to touch the fruits. How do they feel? Smooth? Rough?"

Child A: "The grape is smooth and small."

Child B: "The apple and pear are kind of hard, Miss."

Teacher: "Excellent! You already know many fruits, their colors, tastes, and textures."

From this dialogue, it is clear that the children recognized fruits such as pears, apples, grapes, and bananas. They named the fruits, distinguished their colors (pink, yellow, purple), identified the tastes (sweet

and sour), and described the texture (soft or firm). This activity provided rich and enjoyable sensory experiences, in line with the learning characteristics of early childhood, which rely on concrete and hands-on experiences. As noted by Aslamiyah et al. (2023), science learning can be an alternative to stimulate children's sensory abilities. Sensory-based learning plays a crucial role in supporting early childhood development (Bartan & Alisinanoglu, 2024; Manja et al., 2022), particularly in enhancing cognitive skills and fostering social development. Research shows that experiences involving multiple senses simultaneously (multisensory) significantly contribute to shaping children's learning behavior. Sensory activities also help improve fine motor skills in early childhood (Harahap, 2025; Suharti et al., 2024).

In addition to physical characteristics, the teacher also facilitated a short discussion about the origin and growth of fruits. Children were introduced to how fruits grow and how to care for them, such as watering regularly and protecting them from pests. This is reflected in the following dialogue:

Teacher: "Great! You've all identified these fruits. Now, let's think: where do these fruits grow?"

Child A: "On trees!"

Teacher: "Correct! But there are differences. Bananas grow on tall trees with big leaves. Apples and pears also grow on trees, but their trees are shorter and have dense foliage. What about grapes? Do they grow on trees too?"

Child B: "I don't know, Miss."

Teacher: "Grapes grow by climbing, so they need support to grow upwards. Now, who knows how to take care of fruit plants so they grow well?"

Child C: "Water them every day, Miss."

Child D: "And don't forget to give fertilizer!"

Teacher: "Right! We also need to protect the plants from pests like caterpillars and bugs. If we care for them well, the trees will grow healthy and produce delicious, nutritious fruit."

Child A: "Miss, I want to try planting grapes at home!"

Teacher: "That's a great idea! You can try growing fruit at home and share your experience with your friends later."

From the above dialogue, we can see that the children learned about where fruits grow and the forms of fruit plants (tall trees, short trees, climbing plants), basic plant care: watering, fertilizing, and protecting from pests. Children were encouraged to think critically, discuss, and imagine through a contextual and enjoyable approach. This is in line with Izzuddin (2023), who emphasized that introducing science to early childhood is essential because it fosters the development of critical thinking from an early age.

Furthermore, science learning was extended by discussing the nutritional content and health benefits of fruits, as seen in the following dialogue.

Teacher: "Now let me ask, why do we need to eat fruit every day?"

Child A: "To stay healthy, Miss!"

Teacher: "Correct! Bananas give us energy, apples and pears are rich in fiber for digestion, and grapes have antioxidants that protect our bodies from disease."

Child B: "Miss, I always have a banana in my lunchbox every morning!"

Teacher: "That's great! It helps your body stay energized. Remember, the more colorful your fruits, the more vitamins you get."

Child C: "That means our fruit skewers are super healthy, Miss!"

Teacher: "Exactly! Today we'll learn to eat healthy while playing and creating."

From this discussion about nutrition and fruit benefits, children understood that fruits are not only tasty but also essential for maintaining good health. They learned that bananas provide energy, apples and pears have fiber that aids digestion, and grapes contain antioxidants that help protect the body. They also understood that eating a variety of colorful fruits provides a wider range of vitamins. Through this simple and fun discussion with the teacher, children began to realize the importance of eating fruit daily to stay strong and healthy. Besides enhancing knowledge, this dialogue helped foster awareness of healthy eating habits and improved their communication skills and confidence in expressing ideas.

All of these activities demonstrate that the science aspect can be introduced to children through simple and enjoyable real life experiences. This aligns with Suliani (2025) view that science for early childhood should not be taught theoretically but through exploratory, experience based activities that stimulate curiosity, observation, and early understanding of their environment. Thus, the fun cooking activity "Fruit Skewers" serves as an effective way to build children's early science literacy through meaningful and familiar contexts.

#### *Technology Component in the Fun Cooking Activity "Fruit Skewers"*

The technology component in the STEAM approach is introduced to children through the use of simple tools and utensils that are relevant and safe for use during cooking activities. In the fun cooking activity "Fruit Skewers", children not only learn about food ingredients but also explore various tools with different functions. They are introduced to kitchen tools such as plastic knives, skewers, cutting boards, spoons, forks, plates,

and bowls. This is illustrated in the following teacher-student dialogue.



**Figure 3.** Children Using Simple Cooking Tools and Utensils

Teacher: "Children, before we start making fruit skewers, I want to introduce the tools we'll be using today. Look at this, what is it called?" (Teacher holds up a small cutting board.)

Child A: "That's for cutting, Miss!"

Teacher: "Correct, it's called a cutting board. We use it as a base when cutting fruit, so the table stays clean."

Teacher: "And what about this?" (Teacher shows a plastic knife.)

Child B: "A knife!"

Child C: "But it's a toy knife, Miss?"

Teacher: "Hehe, this is a plastic knife. It's safe for you to use because it's not sharp, but it can cut soft fruits like bananas and pears."

Teacher: "Now, I'm sure you know this one. What's it called?" (Teacher holds up a skewer.)

Child D: "A skewer!"

Teacher: "Yes, we'll use these skewers to put the fruit pieces on."

Teacher: "We also have spoons, forks, plates, and bowls. What do you think they're for?" (Teacher shows the utensils.)

Child A: "The plate is for putting the fruit, Miss!"

Child B: "Spoons and forks are for taking the fruit, so we don't use our hands."

Teacher: "Very good! Each tool has its own function. But we have to use them carefully and take turns, okay?"

From the dialogue above, it is evident that children are able to identify various simple kitchen tools. They understand each tool's function, learn to use them safely and correctly, and develop fine motor skills and hand-eye coordination through the cooking activity. Throughout the activity, the children use these tools directly under the teacher's guidance and supervision. They learn that each tool serves a specific purpose for example, using a cutting board to keep the workspace clean and safe while cutting fruit. Children also learn to

scoop fruit into their plates, use forks to taste the fruit, and assemble the pieces onto skewers.

The children show interest in recognizing various kitchen tools and understanding their uses. This supports the findings of Tasdemir & Yildiz (2024), which indicate that most children have a strong interest in science, understanding how tools and equipment work, and actively participating in experimental activities.

Thus, this fun cooking activity plays a crucial role in shaping children's early understanding of using simple tools as part of technology concepts that are familiar and relevant to their everyday world. Introducing technology to young children should ideally be done through concrete, functional tools used in real life contexts. This allows children not only to know the names of tools but also to understand their practical functions and applications.

#### *Engineering Component in the Fun Cooking Activity "Fruit Skewers"*

The Engineering component in the STEAM approach is reflected in how children are guided to think systematically and follow steps in creating a simple product fruit skewers. In this activity, children are not only asked to assemble fruit onto skewers, but also to understand the entire process from beginning to end.



**Figure 4.** Children Washing, Cutting, and Assembling Fruit

The activity consists of several stages: washing the fruit: The teacher and children work together to wash fruits such as bananas, pears, grapes, and apples before cutting. Children are introduced to the importance of food hygiene before consumption; cutting the fruit: With the help of the teacher, children cut the fruits using plastic knives on a cutting board. The fruit pieces are cut to safe and skewer friendly sizes; and assembling the skewers: Children arrange the fruit pieces on skewers according to their own designs, based on color, size, pattern, or shape.

Through this process, children learn that achieving a result requires planning, step-by-step execution, and evaluation. For instance, if a fruit piece is too large and falls off the skewer, children learn to correct the issue independently. They also practice sequencing tasks,

such as: "First, wash the fruit, then cut it, and finally skewer it."

This activity demonstrates how children begin to develop basic technical understanding and problem-solving skills. A child who was initially confused about the order of the fruit pieces eventually reorganizes them with the support of a peer, showing collaboration and engineering thinking. Thus, the engineering element of this activity helps children learn how something is made from the beginning through logical and systematic steps they can understand and experience firsthand.

Therefore, the engineering aspect is essential in early childhood education. The implementation of STEAM learning at the early childhood level must include a thoughtful analysis of the engineering element to ensure it aligns effectively with 21st-century educational goals, which emphasize the development of four core competencies: communication, collaboration, critical thinking, and creativity (Lestari et al., 2020).

Engineering focused learning is vital from an early age to foster and develop children's constructive thinking skills. Through this type of learning, teachers guide children to engage in designing or creating something that enhances their potential (Siron et al., 2020). Engineering learning provides several benefits for young children, including improving critical thinking and problem solving abilities, encouraging the use of vocabulary and dialogue related to the world of engineering, strengthening understanding of foundational engineering skills, enhancing teamwork abilities, and enabling children to apply these skills across various learning domains (Luthfy et al., 2023).

In conclusion, the engineering component in STEAM learning is important to implement from early childhood, as it helps children think systematically, solve problems, and collaborate. Through activities like making fruit skewers, children learn to follow logical work steps, enhance their creativity, and develop 21st-century skills such as communication, collaboration, critical thinking, and creativity.

#### *The Art Component in the Fun Cooking Activity "Fruit Skewers"*

The Art component in the STEAM approach emphasizes the development of imagination, self-expression, and appreciation of beauty. In the fun cooking activity "Fruit Skewers," artistic aspects emerge naturally as children are given the freedom to arrange fruit pieces based on their own creativity.

Children choose and arrange the fruit pieces in various ways: some based on color (red-yellow-green), shape (round-oval), fruit type (apple-banana-apple-banana), or in random yet visually appealing combinations. Some children attempted to create

patterns such as red-yellow-red or AB-AB-AB and ABC-ABC, although not perfectly. They also paid attention to the balance of light and dark colors, as well as the size of the fruit pieces to make the final result look attractive.



Figure 5. Fruit Skewers Created by Children

In addition to arranging, some children decorated their fruit skewers with toppings like grated cheese or condensed milk provided by the teacher. This activity stimulates aesthetic sensitivity and provides opportunities for children to express themselves and feel proud of their creations.

Throughout the process, the teacher did not evaluate the outcome in terms of "right or wrong," but encouraged children to explain their choices. The children responded with reasons such as, "I like the yellow color in the middle," or "So it looks pretty."

This artistic aspect is important to be integrated into education. Empirical findings show that integrating education with the arts significantly contributes to the enhancement of creativity, critical thinking, innovation, collaboration, and interpersonal communication skills of students (Burton et al., 2000; Liao, 2016). Art integration in early childhood education plays a major role in developing various skills and abilities in children ranging from the role of art in learning processes, the effectiveness of play-based learning approaches, to the development of fine motor skills, creativity, and emotional responsiveness (Nurlina & Bahera, 2024).

In early childhood, art serves as a vital medium for children to explore and understand the world around them. Contemporary scholars and educators agree that art should be integrated into the curriculum from the early stages of child development (Nugraheni & Pamungkas, 2022). Art education for young children aims to nurture creativity, emotion, and initiative as a means to develop their imagination and creative potential. This is important because childhood is a stage of rapid growth in creative thinking abilities. In this context, art functions as a medium for expression and

stimulation that can strengthen children's creative potential (Gunada, 2022).

Thus, art education in early childhood is not solely aimed at producing perfect works but rather focuses on the creative process that fosters self-confidence, appreciation of beauty, and the ability to express ideas visually. The "Fruit Skewers" fun cooking activity serves not only as a thematic learning tool but also as a joyful and meaningful space for artistic exploration for young children.

#### *The Mathematics Component in the Fun Cooking Activity "Fruit Skewers"*

One of the essential cognitive skills in early childhood development is mathematical ability. Mathematics plays a crucial role in modern life due to its wide-ranging influence across various fields. From an early age, mathematics contributes to the development of children's critical thinking skills. Mastery of mathematics is a key competency needed by learners to face real-world challenges and solve problems effectively. The cognitive development of young children can be supported through mathematics instruction appropriate to their developmental stages (Musrikah, 2017; Widiyastuti & Hermawan, 2022). Therefore, early mathematics learning is essential.

The mathematics component in the "Fruit Skewers" fun cooking activity provides children with concrete experiences in understanding basic mathematical concepts through fun and meaningful activities. During the fruit skewer preparation process, children naturally develop their understanding of numbers, shapes, sizes, patterns, comparison, and classification. This is reflected in the following dialogue between the teacher and the children:

Teacher: "Before we assemble the fruit skewers, let's count how many fruit pieces you have on your plates."

Child A (counting): "One, two, three... seven, Miss! I have 2 bananas, 2 grapes, 2 apples, 1 pear."

Teacher: "Great! You can count the fruit. Now, let's group them. Who can separate the same fruits into their own groups?"

Child B (sorting fruits): "I'm putting all the grapes here, apples there, bananas over here."

Teacher: "Good! That's called grouping the fruits by type. Now let's look at the fruit shapes. What shape is the grape?"

Child C: "Small and round, Miss!"

Teacher: "And the apple?"

Child D: "Also round, but bigger than the grape."

Teacher: "What about the banana?"

Child A: "Long and curved!"

Teacher: "And the pear?"

Child B: "Oval, Miss, and bigger at the bottom."

Teacher: "Excellent! Now try comparing their sizes. Which one is the biggest?"

Child C: "The pear is the biggest, then the apple, then the banana, and the smallest is the grape."

Teacher: "Awesome! Today you've learned how to count, sort, recognize shapes, and compare sizes."

From the dialogue above, it is evident that children are learning to count the pieces of fruit. Early introduction to counting is vital, as it is a foundational skill that supports lifelong learning. Counting is an essential skill needed by every individual to apply basic math concepts to everyday problems. At the kindergarten level, children can be introduced to numbers concretely, such as counting from 1 to 10. To facilitate learning, children can practice counting in daily situations. The surrounding environment can also be used as a learning medium, including introducing geometric concepts through everyday objects (Fitria, 2013). The fruit skewer activity helps children learn counting concretely. Through this activity, children develop basic math skills that are essential for daily life and long-term learning.

In addition to counting, children also become familiar with basic geometric shapes such as round (grapes and apples), oval (pears), and long (bananas). They are also asked to compare fruit sizes for example, identifying which fruit is the biggest or smallest and to select evenly sized pieces to make the skewer look neat. Children also learn pattern concepts while arranging the fruit, as shown in the dialogue below:

Teacher: "Now let's try arranging the fruit on the skewer. What pattern do you want to make?"

Child A: "I want apple-grape-apple-grape!"

Teacher: "That's an AB-AB pattern. Anyone want to try another one?"

Child B: "I want banana-grape-pear, and then repeat!"

Teacher: "Wow, that's an ABC-ABC pattern. Great! Now count how many fruits are on your skewer."

Child C: "There are six, Miss! Two apples, two grapes, two pears."

Teacher: "You've also learned to group and count the fruit pieces. Very clever!"

The most interesting part of the dialogue is when children begin arranging the fruit in patterns, either naturally or with the teacher's guidance. Common patterns include AB-AB (e.g., apple-grape-apple-grape) and ABC-ABC (e.g., banana-grape-pear-banana-grape-pear). Some children also arrange based on color (red-yellow), shape (round-oval), or in random but visually appealing sequences. Even if the arrangements are not perfect, children show enthusiasm and begin to grasp the concepts of sequence and order. This aligns with the findings of Lestari et al. (2020), which suggest that structured play activities like

arranging fruits in specific sequences can be an initial strategy for helping children understand patterns and relationships among objects core components of mathematical thinking. Thus, the fun cooking activity not only introduces mathematics in a concrete and contextual manner but also transforms math into a joyful experience rather than an abstract or intimidating subject.

#### *The Impact of STEAM-Based Learning on Early Childhood Development*

The implementation of STEAM-based learning through the fun cooking activity "Fruit Skewers" at TK Aisyah Islamic Preschool has had a comprehensive positive impact on various aspects of early childhood development, including cognitive, language, motor, socio-emotional, creativity, and character domains. This approach offers an active, enjoyable, and meaningful learning process, thereby fostering children's holistic development.

Cognitive development is evident in children's engagement in analyzing, comparing, classifying, and recognizing patterns during the activity. For example, while assembling fruit skewers, children differentiate colors and shapes of fruit (science and mathematics), arrange sequences and patterns (mathematics), and follow systematic procedures (engineering). This activity trains logical thinking, problem solving, and simple decision making skills. STEAM learning has been proven to enhance cognitive development, promote critical thinking, and nurture curiosity and enthusiasm for learning. Children show positive changes, such as increased learning interest, active engagement, creativity, and confidence in expressing ideas (Fanny et al., 2023). They are also encouraged to ask questions, think critically, and seek solutions to problems, while collaborating with peers supporting social skills and teamwork (Huda et al., 2024). The STEAM method also contributes to more creative thinking, enabling children to solve problems more effectively (Wahyuningsih et al., 2019).

Language development is fostered through active interaction between children and teachers or peers. Children mention the names of fruits, describe their taste and shape, and express opinions about the sequence of fruit on the skewer. This process supports the improvement of children's vocabulary and communication abilities both receptive and expressive within the context of science, technology, and healthy food.

Fine motor development is honed as children cut fruit using plastic knives, assemble fruit pieces on skewers, and move their creations to plates. These movements strengthen finger muscles and hand-eye

coordination, essential for future writing skills. In addition, washing fruits and tidying up utensils involve gross motor skills and instill a sense of personal responsibility. Interaction with the textures of fruit also provides beneficial sensory stimulation. Sensory activities have been shown to enhance fine motor development in early childhood (Harahap, 2025; Suharti et al., 2024).

Socio-emotional development emerges through group collaboration, sharing tools, and appreciating others' work. Children learn to take turns, ask for help, and solve problems together. This process fosters self-confidence and pride in their own creations. The integration of engineering elements in STEAM learning supports the development of 21st-century skills, including communication and collaboration (Lestari et al., 2020).

Creativity thrives as children are given the freedom to design their own unique and colorful fruit arrangements. They are encouraged to visually express their imagination, develop originality, flexible thinking, and aesthetic sense. There are no right or wrong answers in creative expression, and every idea is valued. In this activity, children exhibit increased interest, active participation, and the courage to express ideas (Fanny et al., 2023). Art in early childhood education serves as a medium to cultivate imagination, emotion, and initiative, while strengthening creativity (Gunada, 2022).

Character development is shaped through values such as independence, responsibility, cleanliness, discipline, and teamwork. Children understand that good results require structured processes and positive attitudes during implementation.

The "Fruit Skewer" fun cooking activity is a concrete example that STEAM learning can be implemented in a simple and contextual way, without abandoning the essence of play central to early childhood education. The STEAM approach provides diverse and relevant learning experiences for young children (Karlina et al., 2023). In implementing STEAM education, the role of the teacher is highly significant. Quality STEAM implementation at the preschool level depends greatly on teachers' competencies, as they play a central role in planning and managing STEAM activities for children (Nguyen et al., 2025).

Overall, STEAM based early childhood education through the "Fruit Skewer" activity has proven to provide an integrated learning experience with tangible impacts on children's development. This activity demonstrates that the integration of science, technology, engineering, art, and mathematics can be carried out contextually, simply, and joyfully without compromising the essence of play, which is the foundation of early childhood learning.

## Conclusion

The implementation of STEAM-based learning through the "Fruit Skewers" fun cooking activity at TK Aisyah Islamic Preschool has proven effective in stimulating early childhood development holistically. This approach integrates Science, Technology, Engineering, Art, and Mathematics in a contextual and engaging manner, aligned with the characteristics of young children as active and exploratory learners. The findings demonstrate that such activities enhance children's cognitive, language, motor, social-emotional, creative, and character development. STEAM-based fun cooking provides meaningful learning experiences that foster 21st-century skills such as critical thinking, creativity, collaboration, and communication. Therefore, it can be recommended as an innovative learning strategy in early childhood education to support holistic growth and prepare children to face future challenges in the era of Society 5.0.

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## Author Contributions

Conceptualization, A.H.; methodology, A.H.; validation, A.H., A.M.S., and Y.N.; formal analysis, A.H.; investigation, A.H.; resources, A.H.; data curation, A.H.; writing—original draft preparation, A.H.; writing—review and editing, A.M.S. and Y.N.; supervision, Y.N.; project administration, A.H. and A.M.S. All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflict of interest.

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