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A Systematic Review of Fun Cooking Activities for Strengthening Children's Measurement Skills in STEM Education

Dewi Rahmawati[1], Titi Chandrawati[2], dan Erie Siti Syarah[3]

[1,2,3] *Pendidikan Anak Usia Dini, Universitas Terbuka*

ABSTRAK. *Keterampilan pengukuran merupakan dasar penting dalam pembelajaran matematika dan sains pada anak usia dini serta berperan dalam membangun kesiapan STEM. Aktivitas memasak yang menyenangkan (fun cooking), terutama ketika berbasis makanan tradisional, menyediakan pengalaman konkret yang membantu anak memahami konsep berat, volume, dan proporsi dalam konteks budaya yang dekat dengan kehidupan mereka. Penelitian ini merupakan tinjauan sistematis dengan pedoman PRISMA menggunakan basis data Scopus, Web of Science, ERIC, SpringerLink, dan Google Scholar. Dari 327 studi yang diidentifikasi, 28 artikel memenuhi kriteria inklusi dan dianalisis secara tematik. Hasil menunjukkan bahwa fun cooking dapat meningkatkan pemahaman kuantitatif anak, sementara penggunaan makanan tradisional memperkuat relevansi pembelajaran dan nilai budaya. Pendampingan guru dan orang tua berperan penting dalam proses scaffolding, meskipun tantangan seperti keterbatasan alat dan adaptasi kurikulum masih ditemukan. Fun cooking berbasis budaya merupakan pendekatan efektif untuk mendukung keterampilan pengukuran dalam pendidikan STEM usia dini, namun penelitian lanjutan diperlukan untuk menilai dampak jangka panjang.*

Kata Kunci : *Makanan Tradisional; Keterampilan Pengukuran; Pendidikan STEM*

ABSTRACT. *Measurement skills are an important foundation in early childhood mathematics and science learning and play a role in building STEM readiness. Fun cooking activities, especially those based on traditional foods, provide concrete experiences that help children understand the concepts of weight, volume, and proportion in a cultural context that is close to their lives. This study is a systematic review using the PRISMA guidelines and the Scopus, Web of Science, ERIC, SpringerLink, and Google Scholar databases. Of the 327 studies identified, 28 articles met the inclusion criteria and were analyzed thematically. The results show that fun cooking can improve children's quantitative understanding, while the use of traditional foods reinforces the relevance of learning and cultural values. Teacher and parental guidance plays an important role in the scaffolding process, although challenges such as limited tools and curriculum adaptation are still found. Culture-based fun cooking is an effective approach to support measurement skills in early childhood STEM education, but further research is needed to assess the long-term impact.*

Keyword : *Traditional Food; Measurement Skills; STEM Education*

✉ Corresponding author : Dewi Rahmawati
Email Address : mashudadewi2010@gmail.com
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INTRODUCTION

Measuring skills are an important foundation in early childhood education because they support mathematical reasoning, scientific inquiry, and problem solving in everyday life [1]. In the context of STEM, these skills are not only procedural in nature, but also play a role in helping children understand quantitative relationships and connect abstract concepts with real-world experiences [2]. However, children's measurement skills are still relatively low. The results of the 2019 Trends in International Mathematics and Science Study (TIMSS) show that Indonesian children's basic numeracy skills are ranked low, especially in quantitative comparison and measurement [3]. Findings from early childhood education research in Indonesia also show that many young children are not yet able to distinguish sizes, estimate volumes, or understand simple units consistently [4].

To overcome this, a learning approach that is concrete, meaningful, and close to the children's cultural experiences is needed. Fun cooking provides practical opportunities for children to measure, compare, and observe changes in ingredients during the cooking process [5]. When this activity utilizes traditional foods, the values developed include cognitive aspects as well as the preservation of local cultural identity [6]. Although there have been studies related to cooking activities in STEM learning in early childhood education, there has been no systematic review that specifically examines the integration of fun cooking based on traditional foods in the development of measurement skills in early childhood [7].

Previous studies have highlighted the effectiveness of experiential learning such as games, projects, and exploratory activities in supporting mathematics and science understanding in early childhood. This type of learning approach views children as active learners who construct knowledge through direct interaction with objects and their surroundings. Fun cooking activities, in particular, are gaining attention because they provide children with concrete experiences in measuring, comparing, and calculating while remaining engaged in familiar and enjoyable activities [8]. Cooking activities provide children with opportunities to connect mathematics with real-life experiences, for example, when they count pieces of fruit, measure flour, or estimate the amount of water needed. In this context, learning does not occur separately from the real world, but is naturally integrated into children's daily activities [9].

This approach has been proven to improve early numeracy skills through the practice of counting, measuring, and weighing food ingredients directly, making learning meaningful, relevant, and enjoyable [7]. When children are involved in cooking activities, they not only hear explanations about concepts such as numbers or measurements, but also experience the process firsthand through concrete actions. This is in line with constructivist learning theory, which states that children build concepts through concrete experiences and reflection on those experiences. Activities such as making fruit skewers, layered pudding, or character chocolates not only encourage creativity, but also provide opportunities for children to apply concepts of measurement, comparison of quantities, and estimation of volume in a real-world context [10]. For example, when making fruit skewers, children learn about sequence,

number of pieces, and fruit size; when making layered pudding, children understand the concepts of proportion and volume; and in making chocolate characters, children learn about shape, composition, and the ratio of ingredients [11].

In addition to the cognitive dimension, integrating traditional foods into cooking activities has been shown to strengthen cultural identity and enhance the relevance of learning. The use of traditional foods brings the learning process closer to children's lives, increases their sense of belonging to the local culture, and enriches contextual and meaningful learning experiences [12]. Traditional foods are part of a community's value system and collective identity, so cooking with local ingredients or recipes can help children recognize their cultural heritage from an early age. For example, when children are involved in the process of making traditional cakes, they not only learn about the measurements and proportions of ingredients, but also about the social and symbolic meaning of the food in certain events or traditions. Thus, cooking activities using traditional foods have the potential to support two important aspects of early childhood education, namely the development of cognitive competencies and the strengthening of cultural values [13][6].

However, the existing literature is still fragmented. Some studies focus on the relationship between fun cooking and general cognitive development, such as improved fine motor skills, communication skills, or social cooperation. Meanwhile, other studies highlight nutrition or the preservation of local culture as the main benefits of cooking activities for early childhood [14]. Although each study makes an important contribution, few studies link these three aspects measurement skills, fun cooking activities, and cultural reinforcement within a single integrated analytical framework. Only a few reviews explicitly synthesize the contributions of fun cooking based on traditional foods to measurement skills in the context of STEM learning, especially in early childhood [10].

The difference in this study lies in its integrative approach. This study not only discusses fun cooking as a pedagogical method, but also systematically examines the connection between cooking activities, the use of traditional foods, and the development of measurement skills within the framework of culture-based STEM education [15]. This approach seeks to view cooking not merely as a recreational activity or a means of supporting cultural values, but as a tool for building children's scientific and mathematical knowledge in a concrete way. This perspective broadens the discussion of STEM in early childhood education by placing culture at the core of learning, rather than as an additional context or decorative element. In other words, culture is positioned as a source of knowledge and inspiration that helps children understand abstract concepts through symbols and practices that are familiar to them [16].

This study aims to examine empirical evidence regarding the contribution of traditional food-based fun cooking in improving the measurement skills of early childhood in the context of STEM education. This systematic review analyzes recent studies to evaluate the effectiveness of this approach and identify factors that support and hinder its implementation in early childhood education units. This study is expected to provide a theoretical and practical basis for the development of more contextual,

relevant, and locally-rooted learning. In addition, the results of this review also have the potential to serve as a reference for educators, curriculum developers, and policymakers in designing STEM learning programs that are more inclusive, meaningful, and sensitive to cultural diversity.

The main objective of this article is to find, analyze, and synthesize previous research findings that discuss fun cooking activities and the use of traditional foods in the context of STEM education in early childhood, with a particular emphasis on the development of measurement skills. Through this systematic review, the article seeks to understand how culture-based cooking activities can serve as an experiential pedagogical method that not only reinforces numerical and measurement concepts, but also instills cultural identity values in children [17].

The contribution of this study lies in the integrative perspective it offers. Most previous studies have discussed fun cooking only in the context of cognitive development or nutritional literacy, while studies of traditional food ethnomathematics have more often discussed cultural aspects without explicitly linking them to the STEM education framework [18]. This article fills that gap by combining both focuses into a single analytical framework, namely "culture-based STEM through cooking activities." This approach places culture as the foundation of learning, not merely as a background or additional context.

Thus, this study makes two main contributions. First, a theoretical contribution, namely offering a conceptual model of the integration of fun cooking, traditional foods, and measurement skills learning in early childhood STEM education. Second, a practical contribution, namely providing direct implications for the development of a more contextual, inclusive, and meaningful curriculum in line with the needs of early childhood education units in implementing daily life-based learning [19]. This model can be applied in routine classroom activities, project activities, and theme-based learning.

Although there are studies discussing fun cooking in children's learning, systematic studies highlighting the integration of fun cooking based on traditional foods for the development of measurement skills in the context of STEM in early childhood are still limited. There has been no review that synthesizes pedagogical aspects, cultural values, and measurement concepts into a single integrated learning framework. Therefore, this study aims to examine empirical evidence regarding the contribution of fun cooking based on traditional foods in improving the measurement skills of early childhood, as well as to identify supporting factors and implementation challenges as a basis for recommendations for early childhood educators.

METHOD

This study uses a systematic review design in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [20]. A systematic review design was chosen because it is relevant for finding, analyzing, and compiling the results of previous studies related to the use of fun cooking with traditional foods to improve children's measurement skills in the context of STEM

education. The reason for choosing a food-related context was based on recent research findings showing that science/STEM learning programs focused on food can improve scientific understanding and language skills in early childhood. These programs are also considered suitable for integration by teachers in the classroom, making them relevant for the development of early understanding of quantitative concepts such as measurement [21]. This study was conducted from January to May 2025 through the stages of literature identification, screening of titles and abstracts, assessment of full text eligibility, and thematic synthesis in accordance with PRISMA guidelines.

In addition, a recent systematic review of cooking programs for children shows varying effects on cooking skills and eating patterns, reinforcing the importance of systematic research to explore intervention characteristics and outcome indicators more accurately in the context of early mathematics measurement [22]. The dimension of local wisdom is also viewed from the perspective of ethnomathematics in traditional foods, which recent studies show has the potential to improve mathematical skills and understanding in early childhood [23]. The search was conducted on the Scopus, Web of Science, ERIC, ScienceDirect, SpringerLink, and Google Scholar databases. Keywords were formulated using Boolean operators:

Table 1. Literature Search Strategy

Element	Description
Databases	Scopus, Web of Science, ERIC, ScienceDirect, SpringerLink, Google Scholar
Search Keywords	("fun cooking" OR "cooking activity" OR "culinary activity") AND ("traditional food" OR "local food") AND ("children" OR "early childhood" OR "elementary students") AND ("measurement skills" OR "mathematical skills" OR "numeracy skills") AND ("STEM education" OR "science technology engineering mathematics")
Search Example	Scopus: TITLE-ABS-KEY ("fun cooking" AND "traditional food" AND "measurement skills" AND "STEM education")
Time Frame	2015 – 2025 (last 10 years, to ensure up-to-date findings)
Language	English and Indonesian
Document Type	Peer-reviewed journal articles, conference papers, book chapters (excluding editorials, letters, and non-scholarly reports)

The publication range was limited to 2015–2025 to capture the latest developments in culture-based STEM learning. The subjects studied in this systematic review were research articles relevant to the theme discussed, not individuals. The articles were obtained from various international databases such as Scopus, Web of Science, ERIC, and Google Scholar. The search was conducted using the combined keywords "fun cooking," "traditional foods," "STEM education," "measurement skills," and "early childhood." The inclusion criteria included empirical research articles focusing on children from early childhood to elementary school age, with an emphasis on cooking activities related to measurement skills in the context of STEM education. This analysis did not include non-research articles, articles that were not relevant to measurement, or gray literature.

Article selection will follow the systematic steps of the PRISMA framework, including identification, screening, eligibility assessment, and inclusion. Two independent assessors will perform the selection to reduce bias. After this rigorous selection process, a total of 28 studies were identified as meeting all inclusion criteria and were included in the final synthesis. These studies provide diverse perspectives and

contexts, serving as the primary data sources for this review. The included articles will be analyzed using standard data extraction methods, including publication details, study design, participants, type of cooking intervention, STEM pedagogical strategies, and outcome skill measurement indicators. Methodological quality assessment will be performed using tools from the Joanna Briggs Institute [24]. This study aims to provide a comprehensive overview of the effectiveness of traditional food-based cooking activities on measurement skills in early childhood.

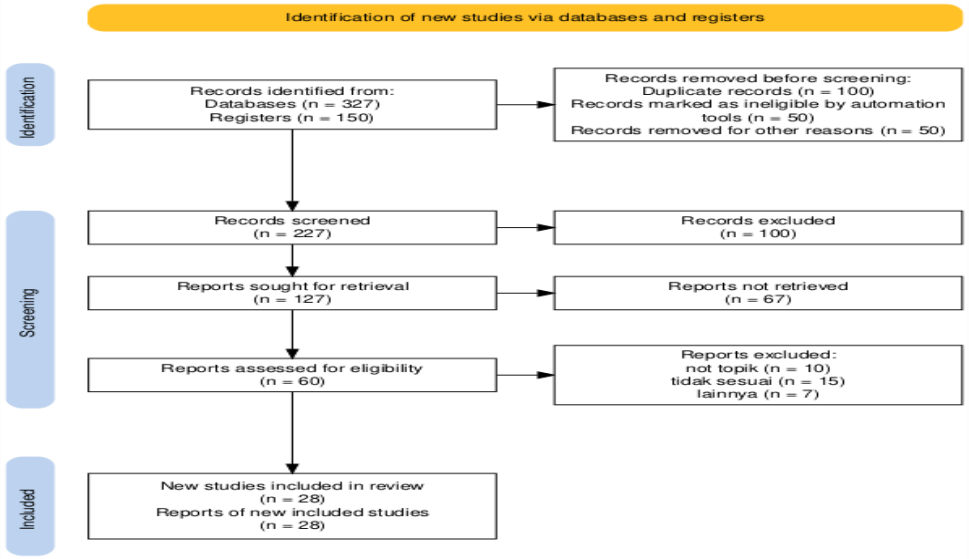
Table 2. Inclusion dan Exsclusion Criteria

Criteria	Inclusion	Exsclusion
Population	Children aged 4–12 years (early childhood and primary school)	Adolescents, adults, or populations outside the target age group
Intervention	Studies involving **fun cooking activities**, **traditional/local food preparation**, or **hands-on food-based learning** related to STEM (especially measurement skills in math/science)	Studies focusing only on nutrition, diet quality, or food security without fun cooking or traditional food element
Outcome	Improvement in **measurement skills** (e.g., volume, weight, length, proportion) and/or **STEM-related learning outcomes**	Outcomes unrelated to measurement skills or STEM education (e.g., only socio-emotional or health outcomes without STEM context)
Study Design	Empirical research (experimental, quasi-experimental, classroom-based interventions, qualitative studies, or mixed-methods)	Opinion papers, editorials, book chapters, commentaries, conference abstracts without full text
Publication Type	Peer-reviewed journal articles, full-text accessible.	Grey literature, unpublished theses/dissertations, non-peer-reviewed sources
Language	Bahasa Inggris atau Bahasa Indonesia	Publications in other languages without translation
Time Frame	Studies published between **2010–2025**	Studies published before 2010

Of the 327 articles identified, 127 articles were screened based on their titles and abstracts, 60 articles were read in full, and 28 articles met all inclusion criteria. The research tools consisted of article selection forms and data collection forms designed in accordance with PRISMA guidelines. The selection forms were used to evaluate the suitability of articles based on predetermined criteria, while the data collection forms contained detailed information such as article identity, year of publication, country, type of research, study topic, context of intervention or learning, and key findings related to measurement skills. The validity of these tools is reinforced through readability testing by two independent assessors to reduce the possibility of bias in the selection process [25][26].

The information gathering process was conducted in four main steps. First, articles were found using keywords in electronic databases. Second, titles and abstracts were reviewed to eliminate irrelevant articles. Third, eligibility was evaluated through a thorough reading of the text. Fourth, articles that met the criteria were included for further analysis. The entire article selection procedure is described in the PRISMA flow diagram [27]. The literature review process was conducted in a structured manner to ensure that the selected articles were relevant to the research topic. Articles that passed the initial selection were evaluated based on the quality of the methods, contextual relevance, and suitability to the research focus. The main objective was to ensure that

the information obtained was comprehensive and scientifically accountable. The literature selection process is described in the following chart:



Picture 1. PRISMA Screening Process

Data analysis was conducted using descriptive and thematic approaches. The descriptive method was used to describe the distribution of articles based on year of publication, country, and type of research. Thematic analysis aimed to identify important themes related to the contribution of fun cooking to traditional foods in improving measurement skills in children. This process used thematic coding techniques with the help of reference management software and qualitative data analysis to ensure consistency in interpretation.

Data Extraction and Analysis Techniques. Each article was analyzed using a data extraction sheet covering: Year of publication and country; Research design and participants; Type of cooking activity and form of traditional food use; STEM learning components applied; Measurement skill indicators and outcomes. Methodological quality assessment was conducted using Joanna Briggs Institute Critical Appraisal Tools [28].

RESULT AND DISCUSSION

The studies analyzed in this review come from several countries, although most were conducted in Indonesia. This condition shows the increasing attention of Indonesian researchers in developing contextual and culture-based learning strategies through fun cooking activities to support STEM education in early childhood. Contributions from South Korea, Australia, Iran, Ireland, Malaysia, and Denmark, although fewer in number, broaden the comparative perspective across educational contexts. This distribution can be seen in Table 3, providing a clear picture of the geographical spread of the literature included in this review.

Table 3. Distribution of Studies by Country

Country	Number of Studies	Percentage
Indonesia	20	71%
South Korea	2	7%
Australia	2	7%
Iran	1	4%
Ireland	1	4%
Malaysia	1	4%
Denmark	1	4%
Total	**28**	**100%**

In addition to geographical distribution, thematic classification shows that cooking activities not only play a role in strengthening STEM concepts, but also in developing other domains such as motor skills, creativity, cultural identity, social-emotional learning, and pedagogical innovation. This confirms that enjoyable cooking is a holistic and integrative learning medium. The distribution of themes is shown in Table 4.

Table 4. Distribution of Studies by Theme

Theme	Number of Studies	Example Studies
STEM/Kognitif	14	Septiana et al (2017), Pratiwi et al. (2022), Alfiyah et al. (2021), Asrifan et al. (2024)
Motor Skills	4	Angelina & Aulina (2024), Rosalianisa & Purwoko (2023), Kumalasari et al. (2024)
Creativity	3	Habibi (2022), Maharani (2023), Fhatri et al. (2024)
Culture/Ethnomathematics	3	Herminastiti (2019), Susanti et al. (2025), Fatmawati & Mariana. (2025)
Socio-Emotional	2	Khazaee (2021), Babys & Watini (2022)
Pedagogical	2	Guarrella et al. (2023), Trias et al. (2024)
Others (Motivation)	1	Budiarti (2021)

The synthesis of the reviewed studies is summarized in Table 5 as a representation of specific contributions to early childhood education skills. Evidence shows that cooking-based activities consistently improve measurement skills such as volume, weight, proportion, and geometry, while supporting creativity, motor development, and interpersonal skills. In addition, studies that integrate traditional foods emphasize the strengthening of cultural identity and contextual learning.

Table 5. Key Focus of Findings

Intervention Focus	Key Findings/Outcomes
Cooking & Fun Cooking	Supported early math concepts: measurement, counting, geometry.
Project & Local Culture	Connected children with cultural values & ethnomathematics.
Creativity & Home Learning	Improved creativity and motivation, especially during COVID-19.
Motor Skills (Fine & Gross)	Developed practical skills: cutting, grasping, stirring.
Socio-Emotional & Collaboration	Enhanced communication, cooperation, and interpersonal intelligence.
Pedagogical & Differentiation	Supported innovative teaching strategies for teachers.
Food Literacy & STEM	Strengthened numeracy, proportion, and food literacy.

This review synthesizes 28 studies examining the effectiveness of enjoyable cooking, particularly traditional cooking, in improving measurement skills in young children in the context of STEM learning. Overall, the findings show that cooking provides sensory, contextual, social, and meaningful learning experiences that

contribute to cognitive, social-emotional, and motor development, as well as strengthening cultural identity.

The following discussion analysis is organized based on key thematic findings and linked to Piaget's constructivism theory and Vygotsky's sociocultural theory. The results not only demonstrate the cognitive and mathematical benefits of enjoyable cooking activities, but also their broader impact on creativity, motor development, social-emotional competence, cultural identity, and food literacy [29].

By analyzing studies conducted in various countries and contexts, this review highlights common patterns and the unique contributions of fun cooking as an educational approach. The following discussion presents the findings in detail, organized according to seven thematic areas that emerged from the analysis: support for basic mathematical concepts; cultural connections and ethnomathematics (sociocultural perspectives); development of creativity and motivation; development of motor skills; communication and interpersonal intelligence; innovative teaching strategies supported for teachers; and improvement of numerical literacy, proportions, and food literacy. These themes provide a comprehensive understanding of how enjoyable cooking can serve as a powerful, culturally relevant, and holistic pedagogical tool in early childhood education.

Support for Basic Mathematical Concepts. Measuring, weighing, and comparing cooking ingredients allows children to build mathematical concepts themselves through direct interaction with real objects. This is in line with Piaget's constructivism theory, which states that children in the preoperational stage understand concepts through concrete manipulation. Experimental studies show an improvement in measurement, proportion, and geometric shape skills in children involved in cooking activities compared to control groups, reinforcing causal evidence that these activities are effective in strengthening early numeracy.

Cross-study comparisons show that results are stronger in studies that facilitate sensory exploration and reflective dialogue than in instructional recipe learning. Thus, the quality of interaction during activities is a key differentiating factor. Several studies show that children understand basic mathematical concepts better when they experience real-life situations, such as measuring food ingredients [30]. This method also involves various senses, which helps increase children's participation in STEM learning. Cooking with traditional ingredients provides real-life experiences that make it easier for children to understand measurement, comparison, and other mathematical processes [23].

Fun cooking can also help children learn basic math in an enjoyable way, such as measurement, grouping, shapes, and number operations [31]. Other studies confirm that children who participate in cooking classes show significant improvement in recognizing geometric shapes, helping them connect abstract concepts with practical experiences [32]. Experimental and quasi-experimental studies [33] providing stronger causal evidence about the relationship between enjoyable cooking and improved measurement skills compared to qualitative studies [10].

Cultural Connections and Ethnomathematics (Socio-Cultural Perspective). Integrating traditional cuisine into learning helps children understand mathematics through experiences rooted in everyday life. This is in line with Vygotsky's theory that knowledge develops through cultural practices and social interactions. Cooking together allows for scaffolding from teachers and peers, reinforcing the process of internalizing concepts [34]. Findings from studies in Indonesia, Malaysia, and Iran show a similar pattern: children find it easier to understand mathematical concepts when learning activities are related to local cultural practices. However, several studies in Western countries emphasize the aspect of independent learning, suggesting that cultural norms regarding collaboration influence the dynamics of learning [35].

Fun cooking is an engaging method for combining STEM education with character and cultural education, providing opportunities for creativity, critical thinking, and mathematics through culturally relevant hands-on activities [10]. Indonesian studies consistently emphasize the integration of traditional foods to strengthen cultural identity and contextual learning [12]. This review highlights that children find it easier to understand mathematical concepts when teaching is related to their culture. Therefore, traditional foods serve not only as a tool for STEM learning but also as a way to strengthen cultural identity. In line with this, the Contextual Teaching and Learning (CTL) approach and other interactive methods significantly improve children's understanding of mathematics through experiences rooted in culture [36],[37]. Therefore, enjoyable cooking not only strengthens children's cultural identity but also develops measurement skills through an ethnomathematics approach within the STEM framework.

Developing Creativity and Motivation. During the COVID-19 pandemic, studies show that cooking at home with parents increases children's motivation to learn and their creativity. This activity allows children to make decisions, choose ingredients, and try different recipes, thereby fostering creative agency. Compared to worksheet-based learning, cooking provides an authentic experience that increases engagement and perseverance. Further practical learning supports children's holistic development. For example, fun cooking activities outside the classroom have been shown to increase creativity in 5- to 6-year-olds through food-making activities that involve imagination and exploration of cooking ingredients [38].

At the same time, cooking activities help maintain and develop children's cognitive abilities through engaging and interactive home-based activities [39]. This has become particularly relevant during the COVID-19 pandemic, when children are more enthusiastic about learning through enjoyable activities such as cooking with their families [40]. This activity not only increases motivation to learn but also strengthens family bonds, encourages a healthy lifestyle, and enhances children's creativity and skills. Cooking can be considered an effective method for developing creativity in early childhood, especially in an interactive learning environment [41].

Motor Skill Development. Activities such as cutting, grinding, and stirring develop fine and gross motor coordination. This process not only strengthens physical coordination but also visual-perceptual integration, which is an important foundation

for writing readiness and other academic activities [42],[43]. Fun cooking contributes significantly to the development of children's practical skills. Research shows that fun cooking improves fine motor skills in children aged 4–5 years, especially in terms of holding, stirring, and cutting food ingredients [44].

In addition, this activity enriches cognitive abilities by introducing concepts such as size, color, and shape, which facilitate cognitive understanding through direct experience [45]. In addition, all of the activities designed successfully improved the children's agility, strength, and gross motor skills. Structured, goal-oriented play activities were also shown to significantly help develop motor skills in young children [46].

Communication and Interpersonal Inteligence. Cooking is done in a collaborative environment that encourages children to discuss roles, share tasks, and express opinions. These interactions strengthen interpersonal intelligence and communication skills, which is in line with Vygotsky's idea that learning is a social process [47]. Enjoyable cooking also strengthens social skills in childhood. Various studies show that cooking activities can develop non-cognitive skills such as socialization, cooperation, and independence. This activity can improve interpersonal intelligence in children aged 5–6 years by encouraging communication, cooperation, and task sharing in a social environment [48]. Other research shows that when the ATIK model is applied to cooking classes in kindergarten, it not only improves children's cooking skills but also strengthens their communication and collaboration abilities [49].

Supported innovative teaching strategies for teachers. Teacher participation is crucial to the success of fun cooking programs. Research shows that teachers trained in experiential learning methods are more effective in helping children connect cooking activities with mathematical and scientific concepts. The quality of teacher-child interactions directly influences children's literacy and numeracy skills, highlighting the importance of strengthening teachers' competencies to integrate fun cooking into STEM education for young children [50]. In addition, differentiated learning strategies integrated into cooking activities offer significant benefits for individual learning, adapting to the diverse needs and abilities of children. In this case, enjoyable cooking is not only beneficial for children but also supports innovative pedagogical strategies for educators [51].

Improved numeracy, proportion, and food literacy. Finally, enjoyable cooking activities using traditional ingredients have been proven effective in improving numerical literacy, proportion, and food literacy. Studies show that enjoyable cooking activities can improve measurement skills in STEM education for early childhood, in line with the findings of Piqueras et al (2019) in [52]. Most interventions successfully improved functional food literacy skills (FNLIT), although few measured food literacy with strong validity [53].

Successful interventions are generally tailored to the needs of children, integrated into the existing curriculum, and facilitated by teachers. Further research is recommended to address the interactive and critical aspects of food literacy more comprehensively. Additional evidence shows a significant improvement in children's

perceived cooking competence after the intervention ($p < 0.05$), accompanied by a significant difference between the intervention and control groups ($p < 0.001$). Process evaluation shows that participants responded very positively, confirming this as an effective model for future children's cooking programs [54]. In addition, garden-based interventions have been shown to be effective in influencing children's vegetable consumption behaviors, confirming that an integrated approach combining gardening activities, nutrition education, and cooking activities can improve children's nutritional knowledge and eating habits [55].

Sensory factors, such as texture and smell, sometimes cause food rejection; however, tactile play, cooking skills, and peer support help increase children's acceptance of new foods such as fish [56]. Based on a thematic synthesis of studies that met the PRISMA criteria, it was found that enjoyable cooking activities consistently provide an authentic context for children to apply measurement skills, such as measuring, weighing, and comparing ingredients, in situations relevant to everyday life. This integration supports STEM learning because children practice quantitative concepts directly through meaningful routine interactions, rather than just through abstract instruction [57].

CONCLUSION

This review shows that traditional food-based fun cooking activities are an effective approach to improving early childhood measurement skills in the context of STEM education because they provide meaningful, culturally relevant, concrete learning experiences that support quantitative concept construction through social interaction. Teacher/parent assistance plays an important role in providing scaffolding during activities. However, most studies are still limited to short intervention durations and have not examined long-term impacts. Therefore, further research needs to use stronger experimental and longitudinal designs and systematically explore the integration of fun cooking into early childhood education curricula to strengthen the impact of sustainable learning.

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REFERENSI

[1] D. B. Y. Tahal and O. Chiș, “Measure With Pleasure: Length Measurement Teaching Framework In Early Childhood,” Mar. 2022, pp. 59–67. doi: 10.15405/epes.22032.6.

[2] Y. A. Ortiz Rocha, A. I. Sacristán, and I. Sandoval, “Spatial Reasoning Experiences in

a STEM Context," *Constr. Conf. Proc.*, vol. 8, pp. 313–324, Jun. 2025, doi: 10.21240/constr/2025/92.X.

[3] R. E. Mubarkah and M. Masriyah, "Kemampuan Numerasi Siswa SMP/MTs yang Bergaya Belajar Visual, Auditorial, dan Kinestetik pada Konten Pengukuran dan Geometri," *MATHEdunesa*, vol. 12, no. 1, pp. 176–193, Jun. 2023, doi: 10.26740/mathedunesa.v12n1.p176-193.

[4] R. Septiana, R. I. Indra Putri, and Y. Hartono, "Mengenal Ukuran dengan Pendekatan PMRI pada Aspek Kognitif Pendidikan Anak Usia Dini," *J. Pendidik. Anak*, vol. 6, no. 2, pp. 137–148, Dec. 2017, doi: 10.21831/jpa.v6i2.17701.

[5] P. Y. Fauziah *et al.*, "Development of Website-Based Traditional Games as an Introduction to Local Culture for Early Age Children," *J. Obs. J. Pendidik. Anak Usia Dini*, vol. 8, no. 5, pp. 869–875, Sep. 2024, doi: 10.31004/obsesi.v8i5.6098.

[6] M. R. Susanti, R. Faizah, K. H. Fadhila, K. H. Fadhila, and A. Khoiri, "Upaya Guru Dalam Pemanfaatan Makanan Tradisional Sebagai Sumber Belajar Berbasis Kearifan Lokal," *JIEEC (Journal Islam. Educ. Early Childhood)*, vol. 7, no. 1, p. 36, Jan. 2025, doi: 10.30587/jieec.v7i1.8862.

[7] D. F. Risina, "Improvement Early Counting Ability with Fun Cooking Activities," *Sci. Eng. Educ. Dev. Stud. Conf. Ser.*, vol. 1, no. 1, pp. 35–42, Apr. 2018, doi: 10.20961/seeds.v1i1.20274.

[8] N. Pratiwi, R. M. Islam, and I. Anggraeni, "Belajar Matematika melalui Fun Cooking pada Anak Usia Dini," *J. Anak Bangsa*, vol. 1, no. 2, pp. 191–197, Aug. 2022, doi: 10.46306/jas.v1i2.19.

[9] A. G. Castillo Vinces, I. A. Gómez Peralta, S. M. Quintana Montalván, and L. S. Vinces Llaguno, "Desarrollo de habilidades matemáticas mediante actividades de cocina y recetas," *Rev. Científica Innovación Educ. y Soc. Actual "ALCON,"* vol. 5, no. 4, pp. 703–711, Aug. 2025, doi: 10.62305/alcon.v5i4.800.

[10] M. M. Habibi, "Fun-Cooking for Early Childhood in Increasing Creativity for Learning at Home During Covid-19 in West Lombok Regency, West Nusa Tenggara, Indonesia," *AL-ISHLAH J. Pendidik.*, vol. 14, no. 4, pp. 6655–6660, Oct. 2022, doi: 10.35445/alishlah.v14i4.2274.

[11] M. Y. Mahendra and R. U. Hasanah, "Etnomatematika terhadap Proses Pembuatan Kue Lapis Pelangi," *Euclid*, vol. 10, no. 2, p. 406, Jul. 2023, doi: 10.33603/e.v10i2.8576.

[12] K. T. Abror, Tasya Zennika, Esa Puspa Meysa Putri, Kinaya Aita Yukuri, and Supriyono, "Peran Makanan Tradisional dalam Menguatkan Identitas Nasional," *J. Budaya Nusant.*, vol. 7, no. 1, pp. 24–35, Sep. 2024, doi: 10.36456/JBN.vol7.no1.8834.

[13] R. Rohmatulloh, A. H. Aan Hasanah, and U. Ruswandi, "Character Education of Food Local Culture Values in The People of Kampung Adat Cirendeu in West Java Through Exemplary," *J. Pendidik. Karakter*, vol. 10, no. 1, Jun. 2020, doi: 10.21831/jpk.v10i1.28658.

[14] A. E. Bennett, D. Mockler, C. Cunningham, C. Glennon-Slattery, and C. Johnston Molloy, "A Review of Experiential School-Based Culinary Interventions for 5–12-Year-Old Children," *Children*, vol. 8, no. 12, p. 1080, Nov. 2021, doi: 10.3390/children8121080.

[15] Evi Nurjannah Siregar and A. Asrul, "Etnomatematika pada Pembuatan Alame dan Lemang Sebagai Makanan Khas Padang Lawas," *Indiktika J. Inov. Pendidik. Mat.*, vol. 6, no. 2, pp. 199–209, Jun. 2023, doi: 10.31851/indiktika.v6i2.15426.

[16] S. Anjarwati, A. E. Aryani, F. F. Azizah, and A. A. Abdullah, "Eksplorasi

Etnomatsains pada Lumpia Semarang serta Implikasi dalam Pembelajaran Matematika dan Sains," *PENDIPA J. Sci. Educ.*, vol. 6, no. 1, pp. 183–192, Aug. 2021, doi: 10.33369/pendipa.6.1.183-192.

[17] E. N. Fatmawati, N. Mariana, and R. Ekawati, "Ethnomathematics in Traditional Culinary Practice: Mathematical Concepts in the Preparation and Sale of Nasi Pecel Tumpang in Kediri, Indonesia," *J. Innov. Res. Prim. Educ.*, vol. 4, no. 3, pp. 1242–1250, Aug. 2025, doi: 10.56916/jirpe.v4i3.1530.

[18] H. A. Hasibuan and Irvan, "Ethnomathematics Exploration of Making Traditional Ombus-ombus Cake Typical of North Tapanuli as a Source of Mathematics Learning," *Mathline J. Mat. dan Pendidik. Mat.*, vol. 10, no. 1, pp. 85–95, Feb. 2025, doi: 10.31943/mathline.v10i1.717.

[19] Intisari, Mutmainnah, and Andi Asrifan, "Integrating STEM in Early Childhood Education: A Cutting-Edge Study on PAUD Development in Indonesia," *Br. J. Teach. Educ. Pedagog.*, vol. 3, no. 1, pp. 74–86, Apr. 2024, doi: 10.32996/bjtep.2024.3.1.7.

[20] M. J. Page *et al.*, "PRISMA 2020 explanation and elaboration: updated guidance and exemplars for reporting systematic reviews," *BMJ*, p. n160, Mar. 2021, doi: 10.1136/bmj.n160.

[21] V. C. Stage *et al.*, "A Food-Based Science, Technology, Engineering, Arts, and Mathematics Learning Program May Improve Preschool Children's Science Knowledge and Language Skills in Rural North Carolina," *Nutrients*, vol. 17, no. 9, p. 1523, Apr. 2025, doi: 10.3390/nu17091523.

[22] K. van der Horst *et al.*, "Outcomes of Children's Cooking Programs: A Systematic Review of Intervention Studies," *J. Nutr. Educ. Behav.*, vol. 56, no. 12, pp. 881–892, Dec. 2024, doi: 10.1016/j.jneb.2024.08.002.

[23] A. F. Wulandari, A. R. Hakim, and S. Kasyadi, "Exploration of Ethnomathematics in Banyumas Traditional Food in Sokaraja Area, Central Java," *Edumatica J. Pendidik. Mat.*, vol. 14, no. 2, pp. 173–185, Nov. 2024, doi: 10.22437/edumatica.v14i2.36947.

[24] N. T. C. Giang, N. T. Q. Anh, T. T. Dao, P. A. Tuan, C. T. H. Linh, and P. T. H. Chau, "A Systematic Review of Problem-Solving Skill Development for Students in STEM Education," *Int. J. Learn. Teach. Educ. Res.*, vol. 23, no. 5, pp. 1–20, May 2024, doi: 10.26803/ijlter.23.5.1.

[25] F. León Pérez, A. Escudero Nahón, and M. del C. Bas Cerdá, "Instrumentos para medir la habilidad de comunicación: una revisión sistemática / Instruments to Measure Communication Skill: A Systematic Review," *RIDE Rev. Iberoam. para la Investig. y el Desarro. Educ.*, vol. 9, no. 18, pp. 102–128, Jan. 2019, doi: 10.23913/ride.v9i18.414.

[26] P. Slater and F. Hasson, "Data Measurement, Instruments and Sampling," *J. Psychiatr. Ment. Health Nurs.*, vol. 32, no. 3, pp. 680–685, Jun. 2025, doi: 10.1111/jpm.13142.

[27] H. Donato and M. Donato, "Etapas na Condução de uma Revisão Sistemática," *Acta Med. Port.*, vol. 32, no. 3, pp. 227–235, Mar. 2019, doi: 10.20344/amp.11923.

[28] Z. Munn *et al.*, "Methodological quality of case series studies," *JBI Database Syst. Rev. Implement. Reports*, vol. Publish Ah, pp. 2127–2133, Sep. 2019, doi: 10.11124/JBISRIR-D-19-00099.

[29] N. Veraksa and I. Pramling, *Piaget and Vygotsky in XXI century*, vol. 4. Cham: Springer International Publishing, 2022. doi: 10.1007/978-3-031-05747-2.

[30] C. Labbé, S. Ward Chiasson, J. B. Dupuis, and C. Johnson, "Effectiveness of a School-Based Culinary Programme on 9- and 10-Year-Old Children's Food Literacy and

Vegetable, Fruit, and Breakfast Consumption," *Nutrients*, vol. 15, no. 6, p. 1520, Mar. 2023, doi: 10.3390/nu15061520.

[31] F. Vogt, B. Hauser, R. Stebler, K. Rechsteiner, and C. Urech, "Learning through play – pedagogy and learning outcomes in early childhood mathematics," in *Innovative Approaches in Early Childhood Mathematics*, Routledge, 2020, pp. 127–141. doi: 10.4324/9780429331244-10.

[32] R. Nurapriani, A. Rahma, and R. Alfiyah, "Cooking Class To Improve Geometry Recognition Ability In Early Children," *Indones. J. Islam. Early Child. Educ.*, vol. 6, no. 1, pp. 98–107, Jul. 2021, doi: 10.51529/ijiece.v6i1.241.

[33] R. Indrawati, "Penerapan Metode Pemberian Tugas terhadap Kemampuan Mengenal Bilangan pada Anak Usia Dini," *PAUD Lect. J. Pendidik. Anak Usia Dini*, vol. 5, no. 02, pp. 45–52, Mar. 2022, doi: 10.31849/paud-lectura.v5i02.8736.

[34] S. Strutt, *Inspiring Learning Through Cooking*, 1 st Editi. Abingdon, Oxon ; New York, NY : Routledge, 2019.: Routledge, 2019. doi: 10.4324/9781351048484.

[35] I. K. J. Antara, K. Agustini, and I. G. W. Sudata, "Model Pembelajaran Problem Based Learning Berorientasi Etnomatematika dalam Meningkatkan Kemampuan Matematis Siswa," *J. Educ. Action Res.*, vol. 9, no. 2, pp. 288–297, May 2025, doi: 10.23887/jear.v9i2.87539.

[36] Zulwansyah, M. Ario, and R. Isharyadi, "Pengaruh pendekatan contextual teaching and learning (CTL) terhadap kemampuan penalaran matematis siswa kelas VIII SMP Negeri 5 Ujungbatu," *J. Pendidik Indones.*, vol. 1, no. 2, pp. 70–75, Dec. 2020, doi: 10.61291/jpi.v3i1.15.

[37] G. Fatihatul Jannah, N. Robicha, Khansah Inas Syarifah, and R. Rasilah, "Introduction To Basic Mathematical Concepts Through Learning Media," *J. Math. Instr. Soc. Res. Opin.*, vol. 4, no. 1, pp. 45–58, Dec. 2024, doi: 10.58421/misro.v4i1.290.

[38] Z. Fhatri, Dwi Haryanti, Abdi Susanto, Hari Kiswanto, Wulan Naroh, and Wika Wilandari, "Pembelajaran Outing Class Melalui Kegiatan Fun cooking dalam Mengembangkan Kreativitas Anak Usia 5-6 Tahun," *Kiddo J. Pendidik. Islam Anak Usia Dini*, pp. 556–572, May 2024, doi: 10.19105/kiddo.v1i1.12752.

[39] S. Phillipson, A. Gervasoni, and P. Sullivan, *Engaging Families as Children's First Mathematics Educators*. Singapore: Springer Singapore, 2017. doi: 10.1007/978-981-10-2553-2.

[40] E. Budiarti, "Fun Cooking to Increase Early Childhood Learning Motivation During Covid-19 Pandemic," 2021, vol. 538, no. Icece 2020, pp. 10–13. doi: 10.2991/assehr.k.210322.003.

[41] Jessica Festy Maharani, "Kegiatan Fun Cooking Class dalam Meningkatkan Kreativitas Anak Usia 4-5 Tahun di Bobocil Kids Club Kota Mataram," *J. Transform. Mandalika, e-ISSN 2745-5882, p-ISSN 2962-2956*, vol. 4, no. 4, pp. 137–142, Apr. 2023, doi: 10.36312/jtm.v4i4.1281.

[42] R. Rosalianisa, B. Purwoko, and N. Nurchayati, "Analysis of Early Childhood Fine Motor Skills Through the Application of Learning Media," *IJORER Int. J. Recent Educ. Res.*, vol. 4, no. 3, pp. 309–328, May 2023, doi: 10.46245/ijorer.v4i3.307.

[43] Sukmawati Kumalasari, Evy Tjahjono, and Adi Dwirastati Adinugroho- Horstman, "Stimulasi Motorik Halus Untuk Meningkatkan Kesiapan Menulis Siswa TK YASPORBI," *Keluwih J. Sos. dan Hum.*, vol. 5, no. 1, pp. 12–24, Apr. 2024, doi: 10.24123/soshum.v5i1.6816.

[44] R. L. Angelina and C. N. Aulina, "Meningkatkan Motorik Halus Anak Melalui Kegiatan Fun Cooking Class: Penerapan Pada Anak Usia 4-5 Tahun," *J. Ris. dan*

Inov. Pembelajaran, vol. 4, no. 2, pp. 844–857, Jul. 2024, doi: 10.51574/jrip.v4i2.1688.

[45] R. D. Brown, *Neuroscience of Mathematical Cognitive Development*, no. March. Cham: Springer International Publishing, 2018. doi: 10.1007/978-3-319-76409-2.

[46] S. Yusuf, "Meningkatkan Kemampuan Kognitif Anak Usia 5-6 Tahun dengan Penerapan Kegiatan Fun Cooking di TK Al Muhajirin Kota Malang," *J. Pendidik. Ris. dan Konseptual*, vol. 4, no. 4, p. 632, Oct. 2020, doi: 10.28926/riset_konseptual.v4i4.303.

[47] M. Khazaee, *Advances in Human Factors in Training, Education, and Learning Sciences*, vol. 1211, no. January. Cham: Springer International Publishing, 2020. doi: 10.1007/978-3-030-50896-8.

[48] P. Sutapa, K. W. Pratama, M. M. Rosly, S. K. S. Ali, and M. Karakauki, "Improving Motor Skills in Early Childhood through Goal-Oriented Play Activity," *Children*, vol. 8, no. 11, p. 994, Nov. 2021, doi: 10.3390/children8110994.

[49] I. S. Babys and S. Watini, "Implementasi Model ATIK dalam Kegiatan Cooking Class Anak Usia 5-6 Tahun di TK Kristen Permata Sentani," *J. Pendidik. Tambusai*, vol. 6, no. 3, pp. 13922–13929, Jul. 2022, doi: 10.31004/jptam.v6i3.4807.

[50] D. Sinaga, "Teacher-Student Interaction Models: Effective Strategies for Increasing Student Participation and Motivation," *JTP - J. Teknol. Pendidik.*, vol. 26, no. 3, pp. 1052–1066, Dec. 2024, doi: 10.21009/jtp.v26i3.50372.

[51] F. I. Yani and E. Budiarti, "Pembelajaran Berdiferensiasi pada Anak Usia Dini melalui Kegiatan Fun Cooking Auting Class pada PAUD Ceria Bekasi," *J. Teach. Educ. Area*, vol. 1, no. 2, pp. 215–231, Jun. 2024, doi: 10.69673/j4e4hw78.

[52] M. Trias, S. N. Ilyas, and U. Bafadal, "The Implementation of Differentiated Learning Strategies through Fun Cooking Activities of Kindergarden," *EduLine J. Educ. Learn. Innov.*, vol. 4, no. 1, pp. 174–181, Mar. 2024, doi: 10.35877/454RI.eduline2468.

[53] M. Garaigordobil, L. Berrueco, and M. Celume, "Developing Children's Creativity and Social-Emotional Competencies through Play: Summary of Twenty Years of Findings of the Evidence-Based Interventions 'Game Program,'" *J. Intell.*, vol. 10, no. 4, p. 77, Oct. 2022, doi: 10.3390/jintelligence10040077.

[54] N. Omidvar, A. Doustmohammadian, E. Shakibazadeh, C. C. T. Clark, M. S. Kasaii, and M. Hajigholam-Saryazdi, "Effects of school-based interventions on Food and Nutrition Literacy (FNLIT) in primary-school-age children: a systematic review," *Br. J. Nutr.*, vol. 129, no. 12, pp. 2102–2121, Jun. 2023, doi: 10.1017/S0007114522002811.

[55] J. Gonsalves, D. Hunter, and N. Lauridsen, "School gardens," in *Agrobiodiversity, School Gardens and Healthy Diets*, no. March, Abingdon, Oxon; New York, NY: Routledge, 2020.: Routledge, 2020, pp. 1–32. doi: 10.4324/9780429053788-1.

[56] S. Kim and S.-A. Park, "Garden-Based Integrated Intervention for Improving Children's Eating Behavior for Vegetables," *Int. J. Environ. Res. Public Health*, vol. 17, no. 4, p. 1257, Feb. 2020, doi: 10.3390/ijerph17041257.

[57] R. Herminastiti, "Peran Kegiatan Fun cooking dan Country Project dalam Kemampuan Matematika Awal dan Berpikir Kritis Anak Usia Dini," *KINDERGARTEN J. Islam. Early Child. Educ.*, vol. 2, no. 1, p. 6, Apr. 2019, doi: 10.24014/kjiece.v2i1.6993.