

THE CURRENT STATUS OF PROVINCE PRESCHOOL TEACHERS' KNOWLEDGE AND SKILLS IN DEVELOPING MEASUREMENT SKILLS FOR CHILDREN AGED 5-6 THROUGH STEAM-BASED ACTIVITIES

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ARTICLE INFO		ABSTRACT
Received:	01/01/2026	Measurement skills constitute a fundamental component of early mathematical competence and play a crucial role in fostering logical thinking, estimation, comparison, and problem-solving abilities in children aged 5–6. STEAM-based educational activities are widely regarded as an effective approach to developing these skills through integrated and experiential learning. This study, entitled “Preschool Teachers’ Knowledge and Skills in Developing Measurement Skills for Children Aged 5–6 Through STEAM Activities,” investigates the current status of teachers’ knowledge and skills in supporting the development of measurement skills among children, based on a survey of 50 preschool teachers and administrators in Tuyen Quang Province, Vietnam. A mixed-methods approach was employed, incorporating classroom observations, questionnaire-based surveys, in-depth interviews, and mathematical statistical analysis to collect, analyze, and evaluate the data. The findings indicate that most teachers frequently apply methods and procedures for organizing STEAM activities; however, their level of knowledge and skills in fostering measurement skills for children aged 5–6 through these activities was assessed as moderate. These findings provide a scientific basis for proposing solutions to enhance the effectiveness of developing measurement skills through STEAM activities in preschool settings in the future.
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Knowledge; Measurement skills; Children aged 5-6; STEAM education.		

1. INTRODUCTION

In the context of fundamental and comprehensive reforms in early childhood education toward a competency-based approach, Official Document No. 4868/BDGDT-GDMN (2024–2025), issued by the Ministry of Education and Training (MOET), Early Childhood Education Department, emphasizes a shift from knowledge transmission to the organization of child-centered educational activities, encouraging children to learn through play, experience, and collaboration. The document also calls for the increased adoption of advanced, modern, and

integrated educational models to enhance the quality of school readiness for five-year-old children, while ensuring continuity between early childhood and primary education. However, the practical implementation of these orientations continues to face significant challenges, particularly in selecting and applying pedagogical models that are appropriate to children's cognitive characteristics and learning capacities.

In early childhood mathematics education, the development of foundational knowledge should be closely connected to real-life experiences in order to foster thinking, problem-solving abilities, and the application of knowledge in everyday contexts. STEAM-based activities, which integrate science, technology, engineering, arts, and mathematics, are considered an appropriate pedagogical approach, providing opportunities for children aged 5–6 to engage in exploration, hands-on activities, and problem-solving. Within this framework, measurement skills play a pivotal role, not only in the formation of basic mathematical concepts but also in the development of logical thinking, comparison, estimation, and collaborative skills.

2. RELATED WORKS

The development of measurement skills for children aged 5–6 through STEAM-based activities is currently regarded as an essential requirement in early childhood education, contributing to the enhancement of children's cognitive development, logical thinking, and collaborative abilities. Through this approach, children are equipped with the necessary foundation for holistic development and for ensuring effective continuity between early childhood and primary education, in line with the orientation of the Ministry of Education and Training (MOET).

A number of international studies have affirmed the importance of integrating early mathematical skills in young children, particularly measurement skills (Black, L & ed, 2019), (Clements, D. H., & Sarama, J, 2009) , emphasizing that mathematics plays a foundational role in children's cognitive development, with numerical and measurement concepts best developed through real-life experiential contexts. (Ergül, A & Artan, 2017) indicated that measurement skills in preschool children are primarily formed through hands-on activities and direct manipulation; however, their study did not address the integration of interdisciplinary elements within a STEAM-oriented educational framework. From an experiential perspective, (Gómez-Escobar, A & ed, 2023) highlighted the role of hands-on exploration in fostering measurement skills in preschool and early primary children, (Petropoulou, A, & ed., 2024), demonstrated that children acquire many mathematical skills from an early age, particularly in number and operations, whereas domains such as geometry and measurement remain less explored and often present greater challenges. In addition, (Warren, 2011) attracted the engagement of Indigenous children in mathematics learning within early childhood education contexts. From a STEAM-oriented perspective, studies by (Mefharet Veziroglu-Çelik & ed., 2025), (Mengmeng, Y. X., & Zhang, W. X, 2019) have focused on teachers' competencies in organizing STEAM activities and emphasized the importance of creating integrated and experiential learning environments. However, these studies have not provided in-depth analysis of the effectiveness of STEAM activities in developing specific mathematical skills, particularly measurement skills for children

aged 5–6. Overall, although STEAM education and experiential learning have been widely addressed, international research remains limited in clarifying the role of STEAM activities in the development of measurement skills among preschool children.

In Vietnam, numerous studies have addressed the formation and development of measurement skills in preschool children (Đỗ Minh Liên, 2009) emphasized that measurement skills are effectively developed through hands-on activities, comparison, and experiential learning, thereby highlighting the need to innovate early childhood mathematics education toward activity-based, integrated, and individualized approaches, alongside enhancing teachers' capacity to organize learning activities. From a modeling-based perspective (Nguyễn Thị Hoàng Vi, 2024) argued that the application of mathematical modeling in early childhood education contributes to improving the formation of mathematical concepts, including measurement skills. (Nguyễn Thị Hương, 2024) clarified the role and current status of measurement skills and developed an assessment toolkit for children aged 5–6; however, the study did not provide in-depth solutions or procedural frameworks for developing these skills through integrated educational models such as STEAM. (Hoàng Thị Phương, 2020) indicated that applying mathematical knowledge and skills, particularly measurement skills, in real-life contexts contributes to the development of children's logical thinking. In addition, studies on STEAM education by (Nguyễn Thị Luyến, 2020), (Đặng Thị Út Phương và Đinh Lan Anh, 2023), have clarified the nature, characteristics, and significance of STEAM education, while research on STEAM project-based learning in early childhood education (Đặng Út Phương và Hoàng Quế Tình, 2020) and (Trần Việt Nhi, 2024) has consistently confirmed that the application of the STEAM model enhances children's observation, exploration, and scientific thinking abilities, while meeting the current requirements for innovation in early childhood education programs..

The present article reports the findings of a survey on preschool teachers' knowledge and skills in developing measurement skills for children aged 5–6 through STEAM-based activities in selected preschools in Tuyen Quang Province, aiming to provide a timely evaluation of current practices in the context of educational reform and to establish a scientific basis for subsequent research and intervention.

3. PROPOSED METHODOLOGY

The study employed the following groups of research methods. First, theoretical research methods were used, including the analysis and synthesis of relevant literature and previous studies, both domestic and international, to examine the theoretical foundations of developing measurement skills in children aged 5–6 through STEAM-based activities. Second, empirical research methods were applied, including questionnaire-based surveys, interviews, observations, and informal conversations to collect data. Third, data were processed and analyzed using SPSS version 20.0, in combination with Microsoft Excel and mathematical formulas for statistical analysis and data visualization. The evaluation scale based on mean scores (M) was defined as follows: Good ($3.25 \leq M \leq 4.00$), Fair ($2.50 \leq M < 3.25$), Average ($1.75 \leq M < 2.50$), and Poor ($1.00 \leq M < 1.75$).

The study was conducted with a sample of 50 preschool teachers from both urban and rural areas in Tuyen Quang Province, Vietnam.

A limitation of the study is that it focuses solely on assessing the current status of teachers' perceptions and skills within this specific context and does not propose specific measures to address the identified issues in developing measurement skills for children aged 5–6 through STEAM-based activities.

4. RESEARCH RESULTS

4.1. Key Concepts

- *Preschool teachers' knowledge of developing measurement skills for children aged 5–6* refers to a system of professional and pedagogical understanding related to children's cognitive characteristics, the content of measurement skills, instructional methods, and assessment approaches, which teachers apply to effectively organize activities that support children in forming and developing measurement skills.

- *Preschool teachers' skills in developing measurement skills for children aged 5–6* refer to the ability to apply professional and pedagogical knowledge to design, organize, and adapt educational activities that effectively facilitate the development of children's measurement skills.

- *Preschool teachers' knowledge and skills in developing measurement skills for children aged 5–6 through STEAM* - based activities refer to the integrated body of professional knowledge and pedagogical competence required to design, implement, and evaluate interdisciplinary STEAM activities. These activities provide opportunities for children to experience, explore, and apply measurement concepts (e.g., comparison, estimation, and the use of units and measuring tools), thereby fostering mathematical thinking and problem-solving abilities in real-life contexts.

4.2. Preschool Teachers' Knowledge and Skills in Developing Measurement Skills for Children Aged 5–6

- *Preschool teachers' knowledge of developing measurement skills for children aged 5–6* : Developing measurement skills for children aged 5–6 in preschool education not only depends on teaching methods but also relies on teachers' professional and pedagogical knowledge regarding their level of awareness and understanding of measurement skills, which need to be assessed at multiple levels :

- + Mastery of fundamental measurement concepts, including length, mass, volume, and time, as well as basic units and simple measuring tools.

- + Understanding the cognitive developmental characteristics of children aged 5–6, their capacity to acquire measurement concepts, and the relationship between measurement knowledge and real-life experiences.

- + Ability to organize learning activities that enable children to explore, experience, and practice measurement skills in authentic contexts.

- + Capacity to analyze children's measurement skills through observation and assessment in order to identify individual strengths and limitations.

+ Ability to evaluate the effectiveness of educational activities, determine levels of measurement skill development, and adjust instructional approaches accordingly.

+ Ability to design and implement STEAM-based activities that integrate measurement skills with science, engineering, arts, and mathematics to stimulate thinking and problem-solving.

- *Preschool teachers' skills in developing measurement skills for children aged 5–6* are a key determinant of the effectiveness of skill development. These skills can be identified across levels ranging from basic to advanced, including:

+ The ability to identify, classify, and explain measurement skills (e.g., comparison, estimation, use of measurement units, and simple measuring tools) in ways appropriate to children's cognitive characteristics.

+ Skills in conducting surveys, observations, and data collection regarding children's measurement skills during STEAM activities, and using this information to adjust educational plans.

+ The ability to analyze and evaluate children's levels of measurement skill development, identify strengths and limitations, and assess the effectiveness of educational activities.

+ Skills in guiding children to apply measurement skills by integrating mathematical knowledge with real-life experiences, thereby promoting logical thinking, collaboration, and problem-solving.

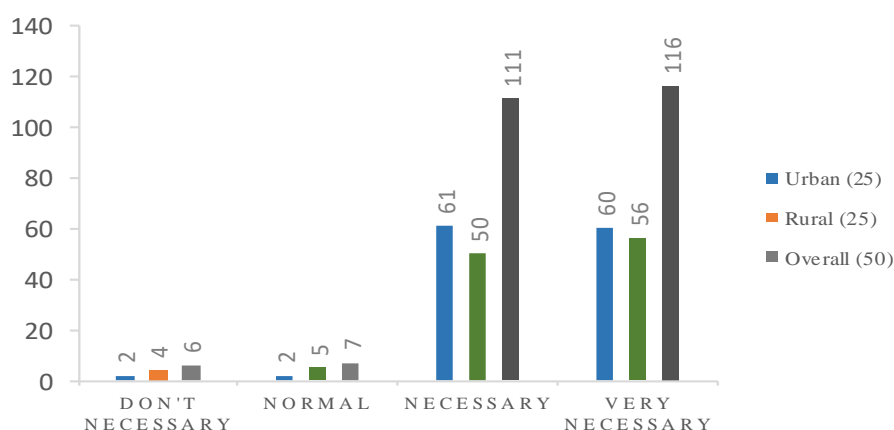
+ The ability to design STEAM-based activities that enhance children's experiences and support the development of measurement skills.

4.3. Current Status of Preschool Teachers' Knowledge and Skills in Developing Measurement Skills for Children Aged 5–6

4.3.1. Preschool Teachers' Perceptions of the Necessity of Developing Measurement Skills for Children Aged 5–6 Through STEAM-Based Activities

A survey of preschool teachers indicates that the development of measurement skills brings significant benefits, particularly for children aged 5–6. The results are illustrated in the following figure :

Figure 1. Preschool teachers' perceptions of the necessity of developing measurement skills for children aged 5–6 through STEAM-based activities



The findings show a very high level of agreement among preschool teachers in both urban and rural areas regarding the necessity of developing measurement skills for children aged 5–6 through STEAM activities, with approximately 94.55% of respondents rating this as “necessary” or “very necessary.” This reflects a positive and relatively consistent perception across regions. In addition, the very small proportion of teachers (below 5.41%) who considered this “unnecessary” or “neutral” is also noteworthy, as it indicates minimal resistance to the implementation of STEAM activities for developing measurement skills. However, this minority group should still be taken into account, as they may face challenges related to instructional capacity, limited facilities, or an incomplete understanding of the nature of STEAM.

4.3.2. Current Status of Preschool Teachers’ Knowledge and Skills in Developing Measurement Skills for Children Aged 5–6

Based on the survey of preschool teachers’ knowledge and skills in develop measurement skills for children aged 5–6, the following results were obtained.

Table 1: Current status of preschool teachers’ knowledge and skills in developing measurement skills for children aged 5–6

Content	Urban (n=25)		Rural (n=25)		Overall (n=50)	
	\bar{x}	SD	\bar{x}	SD	\bar{x}	SD
<i>Preschool Teachers’ Knowledge of Developing Measurement Skills in Children</i>						
Mastery of fundamental measurement concepts, (including length, mass, volume, measurement units, and simple measuring tools)	3,24	0,66	3,16	0,80	3,20	0,73
Accurate understanding of the cognitive developmental characteristics of children aged 5–6, as well as the relationship between measurement knowledge and real-life experiences.	2,04	0,68	2,08	0,70	2,06	0,69
Ability to organize learning activities that enable children to explore, experience, and practice measurement skills in real-life situations.	3,36	0,76	2,20	0,78	2,78	0,77
Ability to analyze children’s measurement skills through observation and assessment, thereby identifying individual strengths and limitations.	2,32	0,85	2,12	0,83	2,22	0,84
Ability to evaluate the effectiveness of measurement skill development and adjust instructional approaches to enhance learning outcomes.	2,12	0,73	1,98	0,45	2,05	0,59
Ability to design and implement measurement activities integrated within STEAM-based approaches.	2,16	0,80	2,00	0,50	2,08	0,65
<i>Preschool Teachers’ Skills in Developing Measurement Skills in Children</i>						
Skills in identifying, classifying, and explaining measurement skills (e.g., comparison, estimation, and the use of measurement units and simple measuring tools) in ways that are appropriate to the cognitive characteristics of children aged 5–6.	2,60	0,87	2,56	0,82	2,58	0,84

Skills in conducting surveys, observations, and data collection regarding children's measurement skills during STEAM-based activities, and using this information to adjust educational plans.	3,16	0,80	2,52	0,87	2,84	0,83
Skills in analyzing and evaluating children's levels of measurement skill development, identifying strengths and limitations, and assessing the effectiveness of educational activities.	2,32	0,75	2,20	0,76	2,26	0,75
Skills in guiding children to apply measurement skills by integrating mathematical knowledge with real-life experiences, thereby promoting logical thinking, collaboration, and problem-solving.	2,24	0,78	2,08	0,76	2,16	0,77
Skills in designing STEAM-based activities to enhance children's learning experiences and support the development of measurement skills.	2,08	0,65	1,88	0,88	1,98	0,76

Overall, teachers' knowledge levels are not uniform and are mainly concentrated at the average to fairly high levels, reflecting the coexistence of both strengths and limitations. Regarding basic knowledge of measurement, teachers in both urban ($M = 3.24$) and rural areas ($M = 3.16$) achieved above-average scores, indicating a solid grasp of fundamental concepts; the relatively low standard deviation ($SD \approx 0.7-0.8$) also reflects a certain level of consistency.

However, in pedagogical and applied aspects, several limitations were identified. Teachers' understanding of children's developmental characteristics shows a relatively low mean score ($M = 2.06$), suggesting difficulties in linking measurement knowledge with the cognitive characteristics of children aged 5–6. Similarly, the ability to organize hands-on measurement activities remains limited, with a notable gap between urban ($M = 3.36$) and rural areas ($M = 2.20$), reflecting disparities in implementation conditions and capacities. In addition, skills related to analysis, evaluation, and instructional adjustment are also at a low level ($M \approx 2.05-2.22$), indicating that teachers are not yet effective in monitoring and supporting children's development. Notably, the ability to integrate measurement activities within a STEAM approach remains limited ($M = 2.08$), particularly in rural areas.

Regarding skills, the results indicate that teachers are generally at a moderate level ($M = 1.88-3.16$), reflecting a situation of "knowing but not yet performing effectively." While teachers demonstrate the ability to recognize and explain measurement knowledge ($M \approx 2.58$), more advanced and practice-oriented skills remain weak. Specifically, skills in surveying, observing, and collecting information show disparities between urban and rural areas ($M = 3.16$ vs. 2.52), while the capacity to analyze and evaluate children's development remains limited ($M \approx 2.26$). Notably, skills in guiding children to engage in experiential measurement activities ($M = 2.16$) and in designing integrated STEAM activities ($M = 1.98$) are particularly weak, indicating challenges in organizing integrated and creative learning activities. Overall, teachers' professional skills remain limited, especially in experiential activities, assessment, and interdisciplinary integration, with a significant gap between urban and rural areas.

4.3.3. Current Status of Integrating Measurement Skill Development into STEAM Activities

Based on questionnaire data and follow-up discussions with preschool teachers, the following results were obtained:

Table 2. Level of integrating measurement skill development into STEAM activities for children aged 5–6

Content		Urban (n=25)		Rural (n=25)		Overall (n=50)	
		\bar{x}	SD	\bar{x}	SD	\bar{x}	SD
1	Measuring the length of objects using different units of measurement.	3,79	0,70	3,51	0,50	3,65	0,85
2	Measuring the length of objects using different units of measurement.	3,21	0,85	3,15	0,79	3,18	0,82
3	Measuring the volume of objects, comparing results, and expressing measurement outcomes	2,97	0,85	2,80	0,93	2,88	0,89

The results are reflected in the mean (M) and standard deviation (SD) values of the surveyed activities. For example, in measuring the length of objects using different units, teachers in urban areas reported a higher level of implementation than those in rural areas (M = 3.79, SD = 0.70 vs. M = 3.51, SD = 0.50). The overall mean score (M = 3.65, SD = 0.85) indicates that this content is implemented relatively frequently in both areas. For similar measurement tasks, the level of implementation between urban and rural teachers is relatively comparable (M = 3.21, SD = 0.85 vs. M = 3.15, SD = 0.79), with an overall mean of M = 3.18 (SD = 0.82), suggesting a generally consistent level of practice. In contrast, activities involving volume measurement, comparison, and verbalization of results are implemented less frequently. Teachers in urban areas reported M = 2.97 (SD = 0.85), while those in rural areas reported M = 2.80 (SD = 0.93), with an overall mean of M = 2.88 (SD = 0.89), indicating certain limitations in organizing these activities. Interviews revealed that “*teachers tend to avoid such activities because they often involve materials such as water, sand, or loose objects, which can be messy, time-consuming to prepare, and difficult to manage in classroom settings.*”

4.3.4 Current Status of Preschool Teachers’ Use of Methods, Strategies, and Procedures in Developing Measurement Skills Through STEAM Activities

To evaluate teachers’ use of instructional methods, strategies, and procedures in developing measurement skills for children aged 5–6 through STEAM activities, the study employed questionnaires and direct discussions. The results are presented in Figure 2.

The overall mean score for the use of pedagogical strategies indicates that teachers in urban areas (M = 2.69) performed slightly better than those in rural areas (M = 2.35). Although the quantitative difference is not large, it reflects meaningful differences in instructional structure. In urban areas, the most frequently used strategies include experiential and exploratory learning, guided discussion, task assignment, and the use of open-ended questions (all with M = 3.15), suggesting that teachers actively guide children’s cognitive processes. In contrast, in rural areas, only experiential and exploratory learning reached a relatively high level (M = 3.02), while strategies that stimulate higher-order thinking, such as discussion and open-ended

questioning, remained at a moderate level ($M = 2.17$), indicating that instructional innovation is still more focused on activity organization than on cognitive depth.

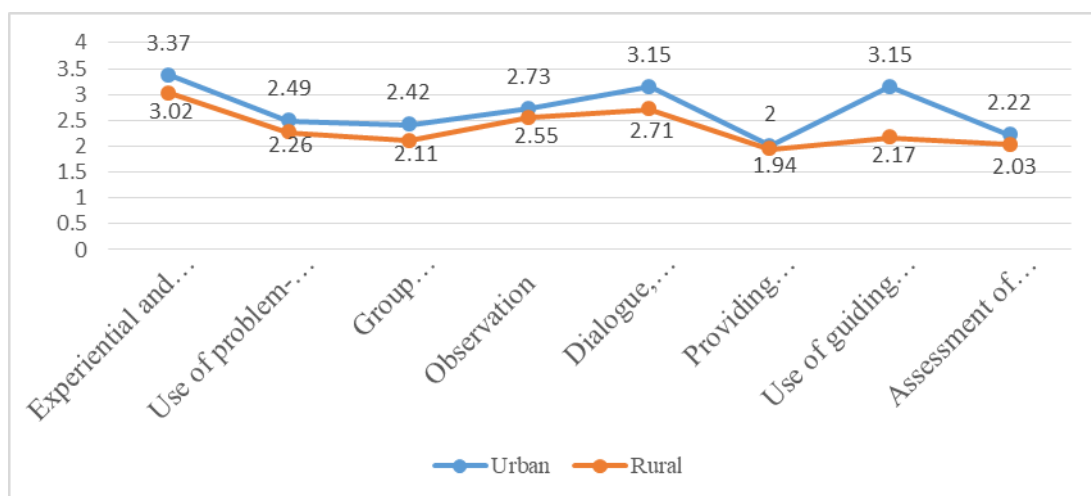


Figure 2. Level of preschool teachers' use of instructional methods and strategies in developing measurement skills through STEAM activities

A notable imbalance is observed in the use of strategies aimed at developing higher-order skills, such as idea presentation (urban: $M = 2.00$; rural: $M = 1.94$) and group collaboration (urban: $M = 2.42$; rural: $M = 2.11$), both of which remain at low levels. This suggests that children are not yet fully positioned as active agents in the learning process and lack sufficient opportunities to express ideas, engage in dialogue, and co-construct knowledge. Consequently, independent thinking cannot be deeply developed, as independence involves not only “doing independently” but also “thinking independently.”

From the above analysis, it can be concluded that the key issue lies not in whether instructional strategies are applied, but in how and to what depth they are implemented. Therefore, professional development should focus on enhancing teachers' capacity to design open-ended learning sequences, promote dialogue and collaboration, and encourage idea expression, thereby shifting from “organizing activities” to effectively “facilitating cognitive processes” in children.

Table 3. Current status of preschool teachers' use of procedures in developing measurement skills for children aged 5–6 through STE

Content	Urban (n=25)		Rural (n=25)		Overall (n=50)		Level
	\bar{x}	SD	\bar{x}	SD	\bar{x}	SD	
1 Traditional teaching procedures	2,03	0,62	1,98	0,66	2,00	0,64	Necessary
2 The 5E instructional model (Engage, Explore, Explain, Apply, Evaluate)	3,45	0,40	3,05	0,75	3,25	0,57	Moderate
3 The Engineering Design Process (EDP) (Ask, Imagine, Plan, Create, Improve)	1,83	0,64	1,80	0,72	1,81	0,68	Moderate
4 The 6E instructional model	2,73	0,96	2,58	0,90	2,65	0,93	Moderate

	(Engage, Explore, Explain, Engineer, Extend, Evaluate)							
5	Problem-based teaching approach	1,95	0,33	1,75	0,46	1,87	0,39	Moderate

The analysis of the data indicates that the implementation levels of instructional procedures range from $M = 1.81$ to $M = 3.25$, reflecting considerable variation in teachers' adoption and application of current pedagogical processes. Specifically, traditional teaching procedures are used at a "necessary" level, with an overall mean of $M = 2.00$ ($SD = 0.64$), suggesting that these approaches continue to be maintained in practice. The level of use is nearly equivalent between urban ($M = 2.03$) and rural teachers ($M = 1.98$), indicating that this is a common and context-independent practice. Among the surveyed procedures, the 5E instructional model shows the highest level of use, with an overall mean of $M = 3.25$ ($SD = 0.57$), corresponding to a moderate level of implementation. However, a notable difference exists between the two groups: urban teachers report higher usage ($M = 3.45$; $SD = 0.40$) compared to rural teachers ($M = 3.05$; $SD = 0.75$). In contrast, more innovative approaches such as the Engineering Design Process (EDP) and problem-based learning exhibit the lowest levels of use, with overall means of $M = 1.81$ ($SD = 0.68$) and $M = 1.87$ ($SD = 0.39$), respectively. The 6E model shows a moderate level of use ($M = 2.65$; $SD = 0.93$), higher than EDP and problem-based learning but still below the level of frequent implementation. These findings suggest that while teachers have begun to engage with extended versions of the 5E model, their application remains exploratory and uneven.

4.3.5. Factors Influencing the Development of Measurement Skills for Children Aged 5–6 Through STEAM Activities

To examine preschool teachers' evaluations of the influence of subjective and objective factors on the development of measurement skills for children aged 5–6 through STEAM activities, a four-point Likert scale (ranging from "not necessary" to "very necessary") was employed, combining questionnaire data with follow-up discussions. The results reveal statistically significant differences across all criteria. As illustrated in Figure 3, teachers identified factors related to teacher competence and the educational environment as having the most substantial impact on the development of measurement skills through STEAM activities. In particular, teachers' understanding of measurement skills and STEAM activities was rated as having the strongest influence ($M = 2.36$ for rural teachers; $M = 2.40$ for urban teachers). Factors related to instructional methods and STEAM content were also rated at moderate levels ($M = 2.10$ – 2.18), indicating that appropriate methodological choices and content design aligned with children's developmental characteristics are essential for improving outcomes. In contrast, educational policies and curricular frameworks were rated as having the lowest influence, suggesting that policy directives are not yet strongly perceived in classroom practice. Overall, teachers in both urban and rural areas demonstrated relatively similar evaluations, with mean scores at moderate levels, underscoring the critical role of teacher capacity and the educational environment in enhancing the effectiveness of STEAM education in early childhood settings.

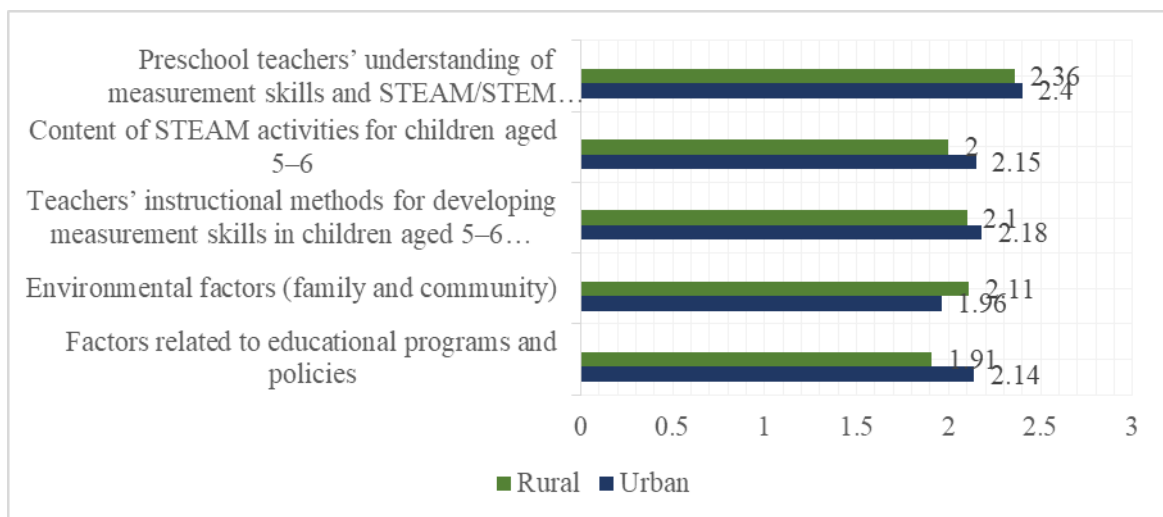


Figure 3. Factors influencing the development of measurement skills for children aged 5–6 through STEAM activities

5. CONCLUSION AND FUTURE DEVELOPMENT

Based on the research findings, it can be concluded that preschool teachers in selected urban and rural areas of Tuyen Quang Province have a clear awareness of the role and necessity of developing measurement skills for children aged 5–6 through STEAM-based activities. However, teachers' knowledge and skills remain uneven and are generally at a moderate level. While teachers demonstrate strengths in foundational knowledge, they encounter difficulties in practical application, particularly in organizing experiential activities, conducting analysis and evaluation, and designing integrated STEAM activities. The use of modern teaching methods and instructional procedures remains limited, often restricted to initial exposure rather than flexible and effective implementation, especially in rural areas. In addition, factors such as teacher competence, facilities, instructional materials, and the educational environment significantly influence implementation effectiveness.

These findings indicate that preschool teachers' knowledge and skills in developing measurement skills through STEAM activities remain limited. Although STEAM represents a promising and appropriate approach, its implementation has not yet been systematic. This study provides a scientific basis for proposing measures to enhance teachers' professional capacity, thereby contributing to improving the quality of early childhood education.

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REFERENCES

1. A. Gomez-Escobar, A. R.-C. (2023). Children's understanding of length measurement using a ruler in preschool and primary education: A cross-national longitudinal study. *Journal of Mathematical Behavior*. <https://doi.org/https://doi.org/10.1016/j.jmathb.2023.101048>
2. Black, L. C.-S. (2019). Theorising the place of emotion–cognition in research on mathematical identities: The case of early years mathematics. *ZDM–Mathematics Education*(51(3)), 379–389. <https://doi.org/https://doi.org/10.1007>

3. Clements, D. H. (2009). *Learning and teaching early math: The learning trajectories approach*.
4. Dang, U. P. (2020). Preschool teachers' awareness of STEAM education in response to educational innovation requirements. *Journal of Science, Hanoi National University of Education*(65(11A)), 125–135.
5. Đàng Ut Phuong, Đinh lan Anh (2023). Applying the 5E instructional model and the engineering design process (vEDP) in STEAM educational activities to develop problem-solving skills for preschool children aged 5–6. in *Proc. 3rd Int. Conf. on Innovations in Teaching Education – Digital Transformation in Education: Awareness, Action, and Prospects (ILITE 3)*, 329-341.
6. Do Minh Lien (2009). Foundational orientations for innovating methods of forming elementary mathematical concepts in preschool children and the required competencies of preschool teachers. *VNU Journal of Science: Social Sciences and Humanities*, 25(3).
7. Ergül, A. A. (2017). Children explain their reasoning about measurement. *Journal of Education and Practice*. [Corehttps://scispace.com/pdf/children-explain-their-reasoning-ab](https://scispace.com/pdf/children-explain-their-reasoning-ab)
8. Gómez-Escobar, A & ed. (2023). Children's understanding of length measurement using a ruler in preschool and primary education. *A cross-national longitudinal study. Journal of Mathematical Behavior*.
9. Hoang Thi Phuong (2020). Characteristics of STEAM education for preschool children and the possibility of its integration into the preschool education curriculum. *Journal of Science, Hanoi National University of Education*, 65(11A), 108-116.
10. Hoang Ut Phuong (2020). Preschool teachers' awareness competencies of STEAM education in response to educational innovation requirements. *Journal of Science, Hanoi National University of Education*, 65(11A), 125-135.
11. Mefharet Veziroglu-Çelik & ed. (2025). STEAM in Early Childhood: An Analysis Towards Teachers' and Children's Perspectives. *Early Childhood Education Journal (Springer)*. <https://link.springer.com/article/10.100>
12. Mengmeng, Y. X. (2019). Construction of STEAM curriculum model and case design in kindergarten. *American Journal of Educational Research*, 485–490.
13. Ministry of Education and Training, Digital text 4868/BGĐT-GDMN on “Guidance on implementing tasks for the 2024-2025 school year for preschool education,” Hanoi, august 29, 2024. . (2024). *Ministry of Education and Training, Digital text 4868/BGĐT-GDMN on “Guidance on implementing tasks for the 2024-2025 school year for preschool education*. (G. o.-2. education, Producer) <https://moet.gov.vn>
14. Nguyen Thi Hoang Vi (2024). Mathematical modeling skills of children aged 5–6 through participation in mathematical modeling activities. *Journal of Educational Science*(69(4A)), 208–217. <https://doi.org/https://doi.org/10.18173/2354-1075.2024-0094>
15. Nguyen Thi Huong (2024). Mathematical modeling skills of preschool children aged 5–6 in mathematical modeling activities. *Tan Trao University Journal of Science*, 10(6). [https://doi.org/ doi: 16.10.51453/2354-1431/2024/1279](https://doi.org/doi:16.10.51453/2354-1431/2024/1279).
16. Nguyen Thi Luyen (2020). Organizing STEAM educational activities for preschool children. *Journal of Educational Equipment*, 2, 31-33.
17. Petropoulou, A, & ed. (2024). Investigation of preschoolers' mathematical skills: A systematic literature review. *Educational Process: International Journal*, 13(2), 31-51. <https://doi.org/https://doi.org/10.22521/edupij.2024.132.3>
18. Warren, E. T. (2011). Engaging Indigenous children in mathematics learning in early childhood contexts. *International Journal of Pedagogies and Learning*(6(2), 97–107. <https://doi.org/https://doi.org/10.5172/ijpl.2011.97>