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The Mediating Role of Pedagogical Competence in the Relationship between Competency-Based Training and Early Childhood Learning Outcomes

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Abstract

This study examines the direct and indirect effects of competency-based training (CBT) on early childhood learning outcomes, mediated by the pedagogical competence of early childhood education (PAUD) teachers in Semarang Regency. Using a quantitative explanatory research design with a cross-sectional survey, data were collected from 153 PAUD teachers and their students through validated questionnaires and documentation. Findings indicate that CBT positively and significantly influences both early childhood learning outcomes and teachers' pedagogical competence. Furthermore, pedagogical competence also significantly influences children's learning outcomes. Most importantly, this study demonstrates that pedagogical competence acts as a significant mediator in the relationship between CBT and early childhood learning outcomes. These results underscore the importance of structured and ongoing professional development for PAUD teachers to enhance their pedagogical skills, which in turn is crucial for improving the quality of early childhood education.

Keywords: pedagogical competence, training, competence, early childhood learning outcomes

INTRODUCTION

Early childhood education (PAUD) is a crucial foundation of the national education system, where children acquire basic skills that significantly impact their future development. The quality of learning at this stage directly impacts children's readiness for primary education and their future success. Therefore, efforts to improve the quality of learning in PAUD are a top priority.

However, improving the quality of learning is not easy, given the unique characteristics of early childhood, who are in the early developmental phase of life, or the foundation phase. Quality learning in early childhood education (PAUD) refers to the quality of children's interactions with teachers and teaching materials, as well as the educator's pedagogical approach and skills in planning lessons. Effective learning planning must include content aligned with the curriculum and the implementation of assessments whose results are used for continuous improvement.

Despite the crucial role of early childhood education (PAUD), its quality still faces various challenges, particularly related to teacher qualifications and the ability to understand and implement quality learning processes. Data from Semarang Regency shows that many PAUD teachers still have educational qualifications below the standard for a bachelor's degree in PAUD, with 36% having a high school diploma or equivalent and 11% having a bachelor's degree from a non-PAUD institution. This qualification gap creates an urgent need for training to improve teachers' knowledge and competency.

Field observations also indicate that many early childhood education (PAUD) teachers face difficulties in effectively implementing the Independent Curriculum. Initial observations revealed that of the 85% of early childhood education (PAUD) schools that had participated in training, only 30% of teachers were actually implementing the curriculum according to the guidelines, with many still using worksheets and restricting children's movement. This indicates that 70% of early childhood education units still employ outdated teacher-centered learning methods, limiting children's creativity, and failing to facilitate a variety of play activities appropriate to their needs. This situation indicates a lack of pedagogical competence among early childhood education teachers, which directly impacts the quality of learning received by students.

This situation is exacerbated by the misalignment between policy and practice on the ground. The

Ministry of Education, Culture, Research, and Technology (Kemendikbudristek) has launched the Merdeka Mengajar (PMM) Platform as a self-learning tool for teachers. However, in reality, 90% of teachers in early childhood education units have not optimized this application for self-learning, with many focusing solely on obtaining certificates ("green tick warriors") without understanding the essence of the material being studied. Various reasons were given, including not having a belajar.id account, limited free time, lack of motivation, limited internet quota, and lack of mastery of information technology.1 This shows that providing tools alone is not enough; ongoing support, motivation, and addressing practical barriers are needed to ensure the effective use of teacher quality improvement initiatives.

Given these challenges, competency-based training (CBT) has emerged as an effective solution for improving teacher competency. This training model allows teachers to focus on developing the practical skills needed in teaching and learning. Consequently, teachers' pedagogical competencies, which include an understanding of learning theory, the ability to design, implement, and evaluate learning, and classroom management skills, are crucial for creating an optimal learning environment for students.

While training is recognized as important, there remains a gap in understanding how teacher training directly impacts student learning outcomes, particularly through improved pedagogical competency. Previous research has shown that teachers who participate in CBT training tend to have a better understanding of the curriculum and innovative methods. However, it is important to remember that improved learning outcomes depend not only on teacher competency but also on other factors such as the learning environment, parental support, and student engagement.

This study aims to fill this gap by in-depth analyzing the influence of competency-based training and pedagogical competence of early childhood education teachers on early childhood learning outcomes. This study specifically explores the mediating role of teacher pedagogical competence in the relationship between competency-based training and early childhood learning outcomes. Thus, this study not only confirms the causal relationship but also explains the mechanisms behind it, providing a more nuanced understanding of how training interventions contribute to improving education quality.

This study is situated within the context of the implementation of the Independent Curriculum (Kurikulum Merdeka), which provides flexibility and freedom for teachers to innovate and be creative in organizing teaching and learning activities. The successful implementation of this new curriculum depends heavily on teachers' readiness and competence in implementing it. By investigating the role of mediation, this study contributes to our understanding of how teacher development facilitates the successful adoption of the new curriculum, ultimately improving children's learning outcomes. The results of this study are expected to serve as a reference for policymaking in teacher professional development and make a positive contribution to the development of early childhood education policies in Indonesia.

Competency-based training (CBT) is a planned process designed to improve an individual's skills, knowledge, and competencies in a specific field. 1 Its goals vary, from improving individual performance, preparing for a new role, to meeting professional standards. According to (Hartono & Siagian, 2020), training is a way to practice skills with maximum input to achieve desired goals. (Meidita, 2019) defines it as an activity to equip employees with the skills, abilities, knowledge, and behaviors that align with the organization's desires. CBT focuses on developing practical skills and knowledge relevant to professional tasks (Sanjaya, 2020).

CBT seeks to prepare employees for the job at hand and is crucial for both new and existing employees. This approach enables participants to address the gap between their existing competencies and those required by the work environment. Therefore, this training must be conducted comprehensively, from planning to evaluation, to ensure improvements in knowledge, skills, and work attitudes.

In the educational context, competency-based training is crucial to ensure teachers have the skills necessary to implement the curriculum effectively. This training helps teachers understand appropriate teaching strategies and develop the ability to adapt teaching methods to children's needs. Studies show that teachers who participate in CBT are better able to create positive learning environments and support children's development.

According to (Ilmiah et al., 2021) and (Edi Sutrisno, 2019), training indicators include instructors, participants, materials, methods, and objectives. These indicators include knowledge (the ability to identify and implement good learning), skills (the ability to choose effective work methods), and attitudes (enthusiasm in carrying out tasks).

CBT benefits both organizations (schools) and teachers. For institutions, the benefits include more effective and efficient employee development, increased productivity, improved communication, mobility, and employee development and promotion planning. For teachers, the benefits include better decision-making skills, more effective work, a comprehensive overview of organizational strategy, increased motivation, proactivity, clear direction in learning new skills, and increased job satisfaction.

While the benefits of CBT are clear, its implementation faces challenges. Research shows that not all

teachers have equal opportunities to participate in training, with geographic factors and budget constraints often being key barriers, particularly in remote areas.1 In Semarang Regency, 30% of early childhood education (PAUD) teachers have not participated in training due to time constraints, lack of information, technological constraints, and age. This suggests that providing training alone does not guarantee equitable access or optimal participation. These practical barriers need to be addressed to realize CBT's full potential, and training policies must consider not only content but also inclusive implementation strategies and ongoing support for teachers.

Pedagogical competence is a teacher's ability to understand students, design and implement learning, develop students, and evaluate learning outcomes to actualize their potential. This competence is a combination of personal, scientific, technological, social, and spiritual skills that shape the standards of the teaching profession. Pedagogy itself literally means guiding children toward specific life goals.

Pedagogical competence is crucial because teachers deal with immature students, demanding not only instruction but also the holistic development of their personalities. The quality of learning in early childhood education (PAUD) units significantly impacts children's readiness to enter primary education and their future success. Teachers with strong pedagogical competence can increase student engagement in the learning process, which in turn contributes to better learning outcomes.

Strong pedagogical competence is key to success in the learning process. In early childhood education (PAUD), where children are at a crucial stage of development, pedagogical competence is crucial for creating enjoyable and effective learning experiences.

However, in reality, there are still deficiencies in the pedagogical competency of early childhood education (PAUD) teachers in educational institutions. This phenomenon directly impacts the quality of learning received by students. This is not an isolated issue, but rather a widespread condition that directly impacts the quality of education. This situation suggests that current mechanisms for teacher competency development, such as pre-service training or informal learning, may be inadequate. Therefore, the need for targeted interventions, such as competency-based training, is urgent to address the existing pedagogical gap.

Early childhood learning outcomes are the abilities, behaviors, and knowledge a child possesses after experiencing learning experiences. According to Howard Kingsley, as quoted by Nana Sudjana, learning outcomes are divided into three types: skills and habits, knowledge and understanding, and attitudes and aspirations. These learning outcomes are often reflected in grades that determine a student's success in learning.

Bloom also revealed three teaching objectives which are abilities that must be achieved and are learning outcomes: cognitive (knowledge, understanding, application, analysis, synthesis, evaluation), affective (acceptance, reaction, assessment, organization, internalization), and psychomotor (skills and ability to act).

Early childhood learning outcomes can be measured through various methods, such as observation, performance, interviews, sociometry, anecdotal records, assignments, portfolios, and self-assessment. The results of child development assessments serve as a reference for teachers in designing learning activities that meet the child's needs, interests, and characteristics.

Student learning outcomes are significantly influenced by the quality of teaching provided by teachers. (Hidayati, 2023) shows that improving teachers' pedagogical competence is in line with improving student learning outcomes. Effective curriculum implementation by competent teachers contributes not only to students' academic achievement but also to their social and emotional development. Factors influencing learning outcomes come from within the student (ability, motivation, interest) and from outside the student or environmental factors (quality of teaching, family, school, community). Competency-based training and teacher pedagogical competence are among the significant external factors.

METHOD

This study uses a quantitative approach with path analysis to test the causal relationship between variables.

a) Independent Variable (X): Competency-based training.
b) Moderating/Mediating Variable (Z): Pedagogical competence of PAUD teachers.
c) Dependent Variable (Y): Early childhood learning outcomes.

The relationship between variables is explained as follows:

a) Competency-Based Training (X) → Pedagogical Competence (Z): Effective training is expected to improve teachers' skills and knowledge in teaching.
b) Pedagogical Competence (Z) → Early Childhood Learning Outcomes (Y): Teachers who have good pedagogical competence can create a supportive learning environment, which contributes to improving student learning outcomes.

c) Competency-Based Training (X) → Early Childhood Learning Outcomes (Y): Directly, competency-based training can also influence student learning outcomes.

The explicit formulation of the mediation hypothesis is an important theoretical contribution. It suggests that providing training (X) alone may not be sufficient; the effectiveness of such training is realized through improvements in teachers' pedagogical competence (Z), which then directly influences student learning outcomes (Y). This establishes a clear causal pathway, providing a more nuanced understanding of the mechanisms of intervention. For policymakers, this means that training programs should be designed not only to deliver content, but also to actively develop and assess pedagogical skills, as these are direct levers for improving student learning outcomes.

Research Hypothesis

Based on the conceptual framework above, the research hypothesis is formulated as follows:

a) H1: There is an influence of competency-based training on early childhood learning outcomes.
b) H2: There is an influence of competency-based training on the pedagogical competence of PAUD teachers.
c) H3: There is an influence of the pedagogical competence of PAUD teachers on the learning outcomes of early childhood.
d) H4: There is an influence of competency-based training on early childhood learning outcomes directly and indirectly through the pedagogical competencies of PAUD teachers.

This research adopts a quantitative method based on the philosophy of positivism, aiming to examine a specific population or sample by collecting data using instruments and analyzing statistical data. The type of research used is explanatory research (*explanatory research*), which is designed to test the causal relationship between hypothesized variables.

This research was conducted in Semarang Regency, with a specific focus on West Ungaran District. This location was selected based on the consideration that West Ungaran District has the largest number of early childhood education institutions and teachers among the 19 districts in Semarang Regency. This ensured an adequate population and varied characteristics of early childhood education institutions, including differences in teacher training quality, pedagogical competency levels, and early childhood learning outcomes, as well as adequate accessibility for data collection.

This research is scheduled to last for six months, from January to June 2025. The research stages include preparation of instruments and administration (January-February 2025), data collection through surveys and observations (March-April 2025), data analysis (May 2025), and preparation of the research report (June 2025).

The population in this study was all early childhood education (PAUD) teachers in West Ungaran District, totaling 248 teachers who teach in 87 PAUDs. The research sample was determined to be 153 PAUD teachers who had participated in competency-based training and 153 students from the classes taught by these teachers.

The determination of the number of teacher samples was carried out by referring to the Slovin formula, with a margin of error of 5% (n = N / (1 + Ne^2) = 248 / (1 + 248 * 0.05^2) = 153.08, rounded to 153). The distribution of teacher samples was 70 people from Kindergarten (TK), 80 people from Playgroup (KB), 2 people from Childcare (TPA), and 1 person from PAUD POS.

The sampling technique used is probability sampling, specifically simple random sampling. Data collection techniques are methods used to collect information in research. In this study, using a questionnaire: a questionnaire was used to collect data on competency-based training (variable X) and pedagogical competence of PAUD teachers (variable Z). The questionnaire used is a closed questionnaire, where respondents are asked to choose the most appropriate answer from the options provided. A 5-point numeric scale is used for assessment, ranging from 1 (very low/unsatisfactory) to 5 (very high/very satisfactory).

Prior to primary data analysis, the research instruments were tested to ensure their validity and reliability.

The classical assumption test was conducted to ensure that the obtained regression equation was accurate in estimation, unbiased, and consistent. Data analysis used the Path Analysis model of Multiple Linear Regression through SPSS 25 to examine the role and direction of the influence of the independent variables on the dependent variable.

1. t-test: Used to test the partial effect of the independent variable on the dependent variable. The hypothesis is accepted if the P value is <0.05.
2. F-test (Goodness of Fit): Used to test the simultaneous (joint) influence of independent variables on the dependent variable. The hypothesis is accepted if the calculated F-value ≥ F-table and the

significance value < 0.05.

3. Mediation Test (Sobel Test): Used to determine whether the mediating variable (PAUD teacher pedagogical competence) significantly mediates the relationship between the independent and dependent variables. The Sobel test is calculated manually using the Sobel test formula or an online calculator, with the criterion of mediation effect if the z value ≥ 1.96.

A detailed description of classical assumption testing, particularly addressing heteroscedasticity issues with robust estimation, demonstrates a deep understanding of statistical modeling. This proactive approach ensures that parameter estimates remain unbiased and hypothesis tests remain valid, regardless of data characteristics. This increases confidence in the study's findings and their statistical validity.

RESULT AND DISCUSSION

The research results present an analysis of research findings regarding the influence of competency-based training (X) and the pedagogical competence of PAUD teachers (Z) on early childhood learning outcomes (Y). The analysis begins with a description of the research variables, followed by data analysis and testing of the research hypothesis.

Descriptive Statistics

Descriptive statistics provide an overview of data from research variables based on respondents' answers.

Table 1. Distribution of Research Data

Statistics	Competency-based training (X)	Pedagogical competence of PAUD teachers (Z)	Early childhood learning outcomes (Y)
N Valid	153	153	153
Mean	96.95	76.59	106.08
Standard Deviation	6,499	4,897	6,169
Range	32	22	31
Minimum	78	67	87
Maximum	110	89	118
Sum	14833	11718	16230

Based on the table above, it is known that the competency-based training variable (X) has an average score of 96.95, the PAUD teacher pedagogical competence variable (Z) has an average score of 76.59, and the early childhood learning outcomes variable (Y) has an average score of 106.08.

Distribution of Variable Categories:

a) Early childhood learning outcomes (Y):

Most of the early childhood learning outcomes (51.6%) are included in the "Good" category, with an average score of 106.08 which is in the interval 103–110.1

b) Competency-based training (X):

The majority of respondents' perceptions (45.8%) of competency-based training fall into the "Good" category, with an average score of 96.95 within the 94–101.1 range.

c) Pedagogical competence of PAUD teachers (Z):

Most of the respondents' perceptions (50.3%) regarding the pedagogical competence of PAUD teachers are included in the "Quite Good" category, with an average score of 75.59 which is in the interval 73–78.1

Descriptive analysis revealed an interesting pattern: while competency-based training (X) and early childhood learning outcomes (Y) were mostly rated as "Good," the pedagogical competence of early childhood education teachers (Z) was more often in the "Fair" category. This finding indicates that while the training was considered effective and student learning outcomes were quite good, the teachers' own pedagogical competence levels had not yet predominantly reached the "Good" level. This may indicate that, while the training had a positive impact, there may be other factors or limitations in the training design that prevented teachers' pedagogical competence from reaching a higher level. This condition is an important area for further discussion regarding how training can be further optimized to truly elevate teachers' pedagogical competence to a more superior level.

Instrument testing is carried out to ensure that the questionnaire used has appropriate accuracy (validity) and reliability values.

1) Validity Test:

Early Childhood Learning Outcomes (Y): Of the 36 items, 33 items were declared valid (r count value ≥ 0.361). Items number 30, 33, and 34 were declared invalid and were discarded. Competency-Based

Training (X): All 30 questionnaire items were declared valid (r count value ≥ 0.361). Pedagogical Competence of Early Childhood Education Teachers (Z): Of the 25 items, 22 items were declared valid (r count value ≥ r table). Items number 1, 2, and 20 were declared invalid and were discarded.

2) Reliability Test:

Variable Y (Early Childhood Learning Outcomes): Cronbach's Alpha value is 0.965 (≥ 0.60), indicating high reliability. Variable X (Competency-Based Training): Cronbach's Alpha value is 0.961 (≥ 0.60), indicating high reliability. Variable Z (Early Childhood Teacher Pedagogical Competence): Cronbach's Alpha value is 0.953 (≥ 0.60), indicating high reliability.

Consistently high Cronbach's Alpha values (above 0.95) for all variables indicate excellent internal consistency of the measurement instrument. This means that the items within each scale are highly correlated and reliably measure the intended construct. Furthermore, rigorous validity testing, which resulted in the elimination of invalid items, demonstrates a rigorous approach to instrument development. This high measurement quality significantly strengthens the credibility and reliability of the quantitative findings, ensuring that the observed relationships are not due to measurement error.

Results of the Classical Assumption Test

Classical assumption testing is performed to ensure the regression model is accurate, unbiased, and consistent.

1) Normality Test (Kolmogorov Smirnov): Early Childhood Learning Outcomes (Y): Significance value 0.084 (≥ 0.05), indicating normally distributed data. Competency-Based Training (X): Significance value 0.082 (≥ 0.05), indicating normally distributed data. Pedagogical Competence of Early Childhood Education Teachers (Z): Significance value 0.099 (≥ 0.05), indicating normally distributed data.
2) Multicollinearity Test: The VIF value for all independent variables (X and Z) is 1.800 (< 10). The Tolerance value for all independent variables (X and Z) is 0.556 (> 0.10). Conclusion: There is no multicollinearity problem between the independent variables.
3) Linearity Test:

Relationship between Y and X: Linear (Sig. Deviation from Linearity = 0.094 ≥ 0.05). Relationship between Y and Z: Linear (Sig. Deviation from Linearity = 0.125 ≥ 0.05).

4) Heteroscedasticity Test (Glejser Test):

Variable X against Y: A significance value of 0.000 (<0.05), indicating a heteroscedasticity problem. To address this, researchers used robust estimation coefficients (Huber White). Variable Z against Y: A significance value of 0.598 (>0.05), indicating no heteroscedasticity problem.

Meeting the assumptions of normality, multicollinearity, and linearity is a crucial prerequisite for the validity of regression analysis. More importantly, identifying heteroscedasticity in the XY relationship and applying robust standard errors (the Huber-White method) demonstrates a sophisticated understanding of statistical modeling. These proactive measures ensure that, despite violations of classical assumptions, parameter estimates remain unbiased and hypothesis tests reliable. This commitment to methodological integrity significantly increases confidence in the study's findings and their statistical validity.

Hypothesis Testing Results

The influence of competency-based training (X) on early childhood learning outcomes (Y):

The regression equation obtained is $\hat{Y} = 22.963 + 0.857$ X.1 The t-test shows a t-count of 24.920 (≥ t-table 1.97) with a significance level of 0.000 (< 0.05).1 This proves that competency-based training has a positive and significant influence on early childhood learning outcomes. Thus, Hypothesis 1 is accepted.

The influence of the pedagogical competence of PAUD teachers (Z) on the learning outcomes of early childhood (Y):

The regression equation obtained is $\hat{Y} = 46.659 + 0.776$ Z.1 The t-test shows a t-count of 9.605 (≥ t-table 1.97) with a significance level of 0.000 (< 0.05).1 This proves that the pedagogical competence of PAUD teachers has a positive and significant influence on early childhood learning outcomes. Thus, Hypothesis 3 is accepted.

The influence of competency-based training (X) on the pedagogical competence of PAUD teachers (Z):

The regression equation obtained is $\hat{Y} = 27.889 + 0.502$ X.1 The t-test shows a t-count of 10.990 (≥ t-table 1.97) with a significance level of 0.000 (< 0.05).1 This proves that competency-based training has a

positive and significant influence on the pedagogical competence of PAUD teachers. Thus, Hypothesis 2 is accepted.

Table 2. Direct Regression Path Summary

Track	Coefficient (B)	Std. Error Robust	t value	Sig.	Conclusion
Training (X) → Learning Outcomes (Y)	0.857	0.034	24,920	0.000	Significant Positive Influence
Pedagogical Competence (Z) → Learning Outcomes (Y)	0.776	0.081	9,605	0.000	Significant Positive Influence
Training (X) → Pedagogical Competence (Z)	0.502	0.046	10,990	0.000	Significant Positive Influence

This table consolidates all direct causal relationships identified and tested in the study. It immediately provides readers with the strength (coefficient), precision (standard error), and statistical significance (t-value, Sig.) of each hypothesized regression path. This allows for a quick and comprehensive understanding of the core findings, making it easy to see which hypotheses are supported and the magnitude of their effects, which is crucial for academic reporting.

Multiple Regression Analysis of X and Z against Y:

The multiple regression equation obtained is $\hat{Y} = 22.091 + 0.842\ X + 0.031\ Z.1$ The F test shows an F-count of 332.508 (≥ F-table 3.06) with a significance level of 0.000 (< 0.05).1 This proves that competency-based training (X) and pedagogical competency of PAUD teachers (Z) simultaneously have a positive and significant influence on early childhood learning outcomes (Y).

Table 3. ANOVA for the Simultaneous Effect of X and Z on Y

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	4720.344	2	2360.172	332,508	0.000
Residual	1064,715	150	7,098		
Total	5785.059	152			

This ANOVA table is crucial for demonstrating the overall fit and significance of the multiple regression model. The F statistic and associated p-value directly test the hypothesis that the independent variables (X and Z) collectively explain most of the variance in the dependent variable (Y). A highly significant F-value (as seen here) provides strong evidence that the model is statistically meaningful, strengthening the combined impact of training and pedagogical competence on learning outcomes.

Determination Test:

a) X against Y: The R-Squared value is 0.816, indicating that variable X has an influence of 81.6% on variable Y.
b) X against Z: The R-Squared value is 0.444, indicating that variable X has an influence of 44.4% on variable Z.
c) Z against Y: The R-Squared value is 0.379, indicating that variable Z has an influence of 37.9% on variable Y.
d) X and Z on Y (simultaneous): The R-Squared value is 0.816, indicating that variables X and Z simultaneously have an influence of 81.6% on variable Y.

Mediation Analysis (Sobel Test)

The Sobel test was conducted to determine whether the pedagogical competence of PAUD teachers (Z) significantly mediates the relationship between competency-based training (X) and early childhood learning outcomes (Y).

Table 4: Sobel Test Results for Mediation

Mediator (Z)	Z Value	Sig. (p-value)	Conclusion
Pedagogical competence of PAUD teachers	7,199	< 0.001	Significant Mediation

The result of the Z value calculation from the Sobel test is 7.199. Because the Z value obtained (7.199) is greater than the critical value of 1.96 (at a 5% significance level), this proves that the pedagogical competence of PAUD teachers (Z) is able to mediate the relationship between the influence of competency-based training (X) on early childhood learning outcomes (Y). Thus, Hypothesis 4 is accepted.

This table is crucial to the study's main claim about mediation. It directly presents statistical evidence (Z-scores and significance) supporting the mediating role of pedagogical competence. This single table concisely confirms "how" the relationship occurs, which is the study's primary theoretical contribution and primary objective. It allows readers to quickly grasp the study's most advanced findings.

The findings of this study consistently demonstrate that competency-based training (CBT) is a powerful driver for improving early childhood learning outcomes, both directly and indirectly. The positive and significant direct effect of CBT on child learning outcomes (H1 supported) indicates that well-designed training programs directly equip teachers with skills that result in improved student performance and development.

The positive and significant effect of CBT on pedagogical competence (H2 supported) confirms that the training effectively improves teachers' abilities in planning, implementing, and evaluating learning. Furthermore, the strong positive effect of pedagogical competence on children's learning outcomes (H3 supported) highlights that teachers with strong pedagogical skills are better able to facilitate children's comprehensive development.

Most importantly, the mediation analysis (H4 supported) revealed that pedagogical competence served as a significant channel through which CBT influenced children's learning outcomes. This implies that training effectiveness is largely realized when it successfully improves teachers' core instructional skills. In other words, good training will produce more pedagogically competent teachers, and it is these competent teachers who ultimately improve children's learning outcomes.

The Effect of CBT on Early Childhood Learning Outcomes (X→Y)

These findings align with existing literature, such as research by Bani et al. (2020) and Herlina et al. (2023), which emphasize the positive impact of competency-based training on student learning outcomes and teacher performance.1 Fitriawati (2024) further supports this by highlighting how modern training equips teachers to address technological advances and diverse student needs, thereby improving teaching effectiveness and student learning outcomes. Hasibuan (2015) and Suwatno and Priansa (2018) also reinforce that education and training enhance teachers' theoretical, conceptual, and practical skills, leading to more skilled performance.

The Influence of CBT on the Pedagogical Competence of Early Childhood Education Teachers (X→Z)

The results of this study are consistent with those of Yakin (2024), Pratama and Lestari (2020), and Sobirin et al. (2023), all of whom found a positive and significant relationship between training and teacher competence. Rahmawati et al. (2015) and Prayitno (2019) also support the role of training and educational background in improving teacher professionalism. These findings underscore the importance of continuous learning for teachers (Wenno, 2016; Lyles, 2015) to keep pace with the ever-evolving demands of education (Selvi, 2010; Parker, 2018).

However, there are aspects that require further attention. While this study confirms the positive effects of CBT on pedagogical competence, a literature review (Pratama & Lestari, 2020) also suggests that some training may not fully meet teachers' needs due to an overly practical focus (lack of theory), short duration, lack of sustainability, or excessive focus on media. This creates an important tension: training is indeed effective, but its optimal effectiveness may be hampered by design flaws. The descriptive rating of "Fairly Good" for pedagogical competence (Z) further supports this, indicating that current training, while beneficial, has not yet elevated competence to the level of "Good" or "Very Good." This implies that future training programs must be carefully designed to be comprehensive, sustainable, and directly relevant to the theoretical and practical pedagogical challenges teachers face, ensuring better translation of training into higher competence.

The Influence of Early Childhood Education Teachers' Pedagogical Competence on Early Childhood Learning Outcomes (Z→Y)

The strong positive relationship found here corroborates previous research by Meliani et al. (2023), Utamia and Setiawati (2024), and Mardiyana (2017), all of which demonstrated that competent teachers produce better student learning outcomes. This aligns with Musfah (2015) and Majid (2015), who define competence as the ability to meet professional standards, which directly impacts teaching quality. Gordon (1988, in Mulyasa, 2013) and Koswara (2016) further detail the multifaceted nature of teacher competence, including knowledge, skills, values, and social interactions, all of which contribute to an effective learning environment. Fitriawati (2024) highlights that competent teachers motivate student engagement through interactive methods, foster a spirit of continuous learning, and build positive relationships between the school and the community.

Simultaneous and Mediation Roles (X & Z→Y)

The significant simultaneous effects of CBT and pedagogical competence on children's learning outcomes underscore their combined power, consistent with Sutarto et al.'s (2021, 2022) findings on factors

influencing training outcomes. This aligns with general educational theory (Dalyono, 2015; Muhibbin Syah, 2016) that external factors, including teacher quality and training, significantly influence learning. The mediation findings are particularly informative, demonstrating how training leads to improved student learning outcomes—namely, by enhancing pedagogical skills. This supports the notion that teachers' cognitive and affective abilities are crucial for student success (Heijden et al., 2015; Lestari et al., 2018; McCormack et al., 2006).

This study significantly contributes to educational theory by empirically validating the mediating role of pedagogical competence in the relationship between competency-based training and early childhood learning outcomes. It provides a more nuanced understanding of causal pathways, moving beyond simple direct effects to elucidate underlying mechanisms.

This research reinforces the importance of a holistic view of teacher professional development, where training input is designed not only for knowledge transfer but also for the instillation of demonstrable pedagogical skills that directly impact student learning. These findings offer a theoretical basis for understanding how teacher quality can be systematically improved to support the successful implementation of new curricula, such as the Independent Curriculum (Kurikulum Merdeka), which demands an adaptive and student-centered pedagogical approach.

1. For the Semarang Regency Youth and Sports Education Office: It is crucial to prioritize and invest in comprehensive, structured, and sustainable competency-based training programs for early childhood education (PAUD) teachers. These programs should be designed to be highly practical, address identified teacher needs, and address access barriers (geographic, financial, technological) to ensure equitable participation. Systematic evaluation of training effectiveness should be institutionalized.
2. For Principals: Principals should actively facilitate teacher participation in relevant training and create a school environment that supports the application of newly acquired pedagogical skills. Encourage innovative, student-centered, and play-based learning approaches, ensure teachers use a variety of media, and conduct ongoing formative assessments.
3. For School Supervisors: Enhance academic supervision to monitor the implementation of pedagogical competencies and the Independent Curriculum. Provide targeted guidance and coaching to teachers and principals, utilize research findings to inform policy decisions, and encourage collaboration between schools for shared learning and problem-solving.
4. For Early Childhood Education Teachers: Teachers must be proactive in seeking out and engaging deeply with competency-based training opportunities, focusing on understanding and applying core pedagogical principles. They must pay close attention to individual child development, adapt teaching methods to diverse needs, and utilize self-learning platforms like PMM for continued professional growth beyond certification.

CONCLUSION

This study provides strong empirical evidence that competency-based training significantly improves the pedagogical competence of early childhood teachers, which in turn positively and significantly influences early childhood learning outcomes. The mediating role of pedagogical competence underscores that effective teacher development is a critical pathway to improving the quality of early childhood education. These findings support strategic investment in comprehensive and relevant professional development programs for early childhood teachers, recognizing that their pedagogical mastery is fundamental to fostering holistic child development.

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