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Comparative Analysis of Competencies for Integrating Climate Action Education between Urban and Rural Primary English Teachers in Jiangsu Province, China

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Abstract

Climate change represents a significant challenge for humanity, with climate action being the 13th goal of the Sustainable Development Goals (SDGs). Education plays a crucial role in addressing this issue, particularly for primary school students, who are at a pivotal stage for climate change education. This study focuses on Jiangsu Province, where disparities in educational resources between urban and rural areas have led to differences in the quality of climate change education. Using a quantitative research method, a questionnaire survey was conducted with 409 primary English teachers in Jiangsu Province to compare and analyze their climate action skills, employing pedagogical content knowledge (PCK) as a framework. The data analysis revealed a significant difference in the ability of urban and rural teachers to integrate climate action into their teaching. Urban teachers demonstrated higher competency, which is attributed to greater professional development opportunities and better educational resources. In contrast, rural teachers faced challenges such as limited training and fewer professional development opportunities, which impacted their effectiveness in integrating climate action. To address these disparities and improve the quality of climate change education, the study suggests the need for balancing educational resources between urban and rural areas and developing targeted policies. These findings offer valuable insights for promoting equity in climate change education in Jiangsu Province and similar regions, and further research could explore the impact of specific policy interventions on reducing these disparities.

Keywords: Climate Action, Climate Change Education, Pedagogical Content Knowledge (Pck), Teachers' Competencies.

Introduction

The Sustainable Development Goals (SDGs), adopted unanimously by UN member states in 2015, outline 17 targets for achieving global progress by 2030, aiming to end poverty and protect the planet. The 13th goal focuses on climate action, defined by the United Nations as the urgent need to combat climate change and its impacts. Climate change poses a significant and immediate threat to ecosystems and human societies alike, encompassing a broad range of measures including mitigation—such as reducing greenhouse gas emissions and developing renewable energy—and adaptation strategies to enhance resilience against extreme weather events (O'Garra et al., 2024).

In this context, education plays a critical role in shaping students' environmental awareness and behaviors by innovating knowledge systems and enhancing competencies (Mora et al., 2020). Primary school education, in particular, is a crucial period for instilling a strong sense of environmental responsibility in children, who are the future leaders of the world (Rousell & Cutter-Mackenzie-Knowles, 2020). Climate change education is multifaceted, encompassing scientific knowledge, policy, ethics, society, and behavior, and thus requires an interdisciplinary approach (Jing et al., 2022).

In China, where there is no standalone environmental curriculum, climate change education must be integrated into existing subjects. English, as an international language, offers a unique opportunity for integrating climate change knowledge. By incorporating environmental content into the English language curriculum, students not only enhance their language skills but also gain a global perspective on environmental issues. This innovative approach to integrating climate change education into various fields is supported by research highlighting its effectiveness (Widyaningrum et al., 2022).

Moreover, the competency of teachers is crucial for successful integration of climate change education. Strengthening the teaching competencies of primary school English teachers is essential for developing the next generation's environmental awareness and promoting effective climate action (Cahyadi & Sari, 2023).

Despite being one of China's most populous and economically developed provinces, Jiangsu faces significant climate-related challenges, including declines in food production and frequent extreme weather events. Research on the impact of climate change on health, such as increased mortality from excessive heat, underscores the urgent need for effective climate change mitigation and adaptation measures in both urban and rural areas of Jiangsu Province (Chen et al., 2017). These challenges highlight the importance of prioritizing climate change education.

However, disparities between urban and rural areas continue to affect the quality and accessibility of climate change education. Although the Jiangsu government has implemented policies to bridge economic and resource gaps between urban and rural areas, significant imbalances persist, particularly between the economically advanced southern urban areas and the less developed northern rural regions (Xiong et al., 2021). This disparity is evident in public services such as education, healthcare, and cultural resources, which are generally superior in urban areas compared to rural ones (Pan et al., 2022). Such imbalances likely contribute to differences in climate action integration competencies among primary school English teachers in urban versus rural areas, impacting the effectiveness and equity of climate change education in Jiangsu Province.

There is a need for comparative analysis of climate action integration competencies between urban and rural primary school English teachers in Jiangsu Province. This study aims to reveal how climate change education varies between different educational settings, with the goal of strengthening climate change education in Jiangsu and providing valuable insights for similar regions seeking to promote equitable and effective climate education policies.

While there is growing recognition of the role of climate change education in developing future environmental citizens and supporting sustainable social development, most research has focused on the urban-rural educational resource gap, the role of science subjects, and teacher engagement in climate action within science education. For example, Skamp et al (2013), emphasize the importance of science education for making informed climate-related decisions, while Song et al (2022), highlight the value of interdisciplinary approaches, and Opuni-Frimpong et al (2022), stress the need for teachers' pedagogical competency in climate education. However, there is a lack of studies comparing the competencies of urban and rural teachers in integrating climate action into English language instruction—a significant research gap.

This study aims to address this gap by comparing and analyzing the climate action integration competencies of English teachers in urban and rural primary schools in Jiangsu Province. The research question guiding this study is whether there is a difference in the climate action integration competencies of English teachers in urban versus rural primary schools. Based on the results, practical recommendations will be made to address competency disparities and ensure equitable access to climate change education for students in both urban and rural areas. Additionally, the study will help primary school English teachers assess and improve their competencies in integrating climate action into their teaching practices.

Literature Review

Climate Action Education

Climate change is a global issue characterized by long-term shifts due to both natural processes and human activities, particularly greenhouse gas emissions since the industrial revolution (Rahmawaty et al., 2024). It has been widely recognized as a primary driver of global warming. The manifestations of climate change include rising global temperatures, sea level increase, and more frequent extreme weather events, which have significant impacts on ecosystems, such as marine acidification, terrestrial fires, and droughts. These changes challenge ecosystem services and threaten coastal biodiversity (Estaque et al., 2023).

In 2015, the United Nations adopted the Sustainable Development Goals (SDGs), with the aim of promoting global sustainable development by 2030. SDG 13 emphasizes the urgent need to address climate change and, alongside other goals (e.g., SDGs 6, 7, 11, and 15), provides a framework for global sustainability (Agbedahin, 2019; Ossiannilsson, 2023).

Countries worldwide, including China, are grappling with the urgent challenges posed by climate change. China's rapid economic development has altered land use patterns, leading to serious ecological and environmental issues alongside economic growth (Zhao et al., 2022; Shan et al., 2020). Liu et al (2023), emphasize that achieving China's targets for peak carbon emissions and carbon neutrality will require effective mitigation policies to address global climate trends, impacting air quality and climate action. Urbanization in China also directly affects energy consumption and carbon emissions, highlighting the need for adaptation measures and sustainable development strategies. Other countries face significant climate challenges as well: Kenya is experiencing threats to agricultural production and food security due to changing precipitation patterns and extreme weather, leading to poverty and social disempowerment (Liru & Heinecken, 2021). India is dealing with the effects of rising sea levels and extreme weather on human health and agriculture, while North America, including the United States and Canada, faces extreme weather events that impact infrastructure, ecosystems, and economic activity. In Latin America, particularly the Amazon basin, deforestation and climate-induced droughts are causing rapid biodiversity loss and impaired ecosystem services (Posocco & Watson, 2022). Australia, with its highly sensitive ecosystems, also faces severe climate challenges. In this context, education plays a crucial role in raising environmental awareness among students and encouraging actions toward achieving the UN SDGs (Fuso Nerini et al., 2019).

In China, there is currently no standalone climate change curriculum; thus, teachers must use an interdisciplinary approach to integrate climate change education. This requires teachers to not only have subject-specific knowledge but also a robust understanding of climate issues and pedagogical content knowledge (Lee et al., 2018). Pedagogical Content Knowledge (PCK) is essential for teaching climate change effectively, as it combines content and pedagogy to make complex topics accessible to students (Favier et al., 2021; Motsoeneng, 2021). By incorporating PCK into their practices, educators can enhance students' learning experiences and deepen their understanding of climate change.

However, disparities between urban and rural areas pose significant challenges for implementing climate change education effectively. Urban schools benefit from advanced

multimedia and network resources, which enhance teaching competencies and promote interactive learning (Nasim, 2024). In contrast, rural schools often suffer from limited resources and lower teacher salaries, restricting opportunities for innovation, professional development, and effective climate change education (Luo et al., 2022). These disparities create challenges for rural teachers in meeting the interdisciplinary demands of climate change education, impacting its overall effectiveness.

While some studies suggest no significant differences in teaching competencies between urban and rural teachers (Kusin, 2022), most research indicates that urban-rural disparities do affect teaching quality. Therefore, it is crucial to develop better policies to support rural teachers and ensure that all students, regardless of location, have access to quality climate change education. This study aims to explore whether differences exist in the competencies of rural and urban primary English teachers in integrating climate action, addressing a significant research gap and providing insights to enhance climate education equity.

Teaching Competency

Teachers' teaching competency encompasses their overall quality and professional skills in education, including a robust knowledge base, effective teaching techniques, a positive educational attitude, and a continuous pursuit of professional development. These competencies significantly impact students' academic performance, classroom behavior, goal-setting, and overall learning experiences (Nasim, 2024; Maritasari et al., 2020). In this study, teaching competency specifically refers to the ability of teachers to integrate climate knowledge into the English curriculum. Enhancing teachers' competency in integrating climate action requires not only content knowledge but also pedagogical content knowledge (Lee et al., 2018).

As educational technology evolves, the definition of teaching competency is expanding to include digital skills. Teachers must now be adept at using a variety of digital tools and resources to enhance teaching efficiency and create engaging, diverse learning experiences for students (Falloon, 2020). Proficiency in digital tools reflects a teacher's ability to modernize their teaching practices and adapt to new educational trends, making the development of digital competency crucial for fostering educational innovation. Districts with better educational resources are thus more likely to support advanced teaching competencies among their teachers.

In primary climate change education, teachers need interdisciplinary knowledge to connect scientific principles with students' everyday lives. They must also employ various teaching strategies to motivate students (Hudson et al., 2018). Effective teaching competency is rooted in pedagogical content knowledge (PCK), which involves integrating subject matter expertise with pedagogical skills. Strong teaching competency is demonstrated through the ability to design lessons that facilitate deeper understanding and mastery of content. Numerous studies have highlighted the importance of assessing teaching competency across different educational contexts. For instance, Yang and Chen (2022) emphasize that excellent teaching competencies are essential for professional teachers and crucial for improving educational quality.

Pedagogical Content Knowledge

Pedagogical Content Knowledge (PCK) is a specialized form of expertise that enables teachers to effectively convey specific content to students (Shulman, 1986). In this study, PCK specifically refers to the knowledge and competency needed by primary school English teachers, both in rural and urban settings, to effectively teach climate change. According to Shulman (1986), the essence of PCK lies in a teacher's ability to combine a deep understanding of the subject matter with the skills required to transfer this knowledge effectively to students. This combination involves not only mastery of the content but also the application of effective pedagogical methods.

PCK encompasses several crucial aspects: setting instructional goals, promoting student understanding, designing lesson content, applying instructional strategies, and assessing learning outcomes (Kutluca, 2021). These elements are integral to enhancing both teaching quality and student achievement.

In the specific context of climate change education, PCK can be categorized into seven dimensions. The first dimension, knowledge of subject matter, involves understanding climate change content and integrating it into the curriculum, which is vital for effective Education for Sustainable Development (ESD) (Howard-Jones et al., 2021). Knowledge of curriculum refers to understanding the curriculum system related to climate change and its implementation. Knowledge of learners pertains to understanding students' backgrounds and their engagement with environmental topics. Instructional strategies involve identifying and applying effective teaching methods for climate change education. The knowledge of climate change context in teaching English encompasses utilizing social, cultural, and tangible resources to teach climate change within the English curriculum. Educational goals involve setting appropriate objectives for climate change education, while knowledge of assessment focuses on applying suitable assessment methods to evaluate climate change education and using the results to refine teaching practices.

PCK is a foundational concept in science education, recognized for its effectiveness in enhancing teaching practices (Cooper et al., 2022). It allows teachers to tailor context-specific knowledge to improve their teaching methods and outcomes (Mientus et al., 2022). Research indicates that teachers with well-developed PCK prioritize student understanding and employ diverse pedagogical approaches to promote deeper learning (Chapoo et al., 2018). Key components of PCK, such as orientation to teaching, understanding student learning, curriculum knowledge, instructional strategies, and assessment, contribute significantly to teacher expertise (Krepf et al., 2017). Studies have shown that integrating PCK into teacher education programs enhances teaching quality and student learning outcomes (Evens et al., 2015).

In environmental education (EE), PCK plays a crucial role in improving teachers' abilities to impart environmental knowledge effectively. Frameworks developed by Abdullah & Halim (2010) and Alimuddin et al. (2020) for assessing PCK in environmental education highlight its importance in evaluating teachers' competencies. PCK helps identify areas for improvement in teaching climate change and supports the development of effective teaching methods (Favier et al., 2021).

This study employs a questionnaire based on these seven dimensions of PCK to assess and compare the climate action integration competencies of urban and rural primary school English teachers. The goal is to analyze differences in their pedagogical competencies and offer recommendations for targeted policies to enhance the effectiveness of climate change education.

Methodology

This study employed quantitative research methods to compare and analyze the competencies of primary school English teachers in urban and rural areas of Jiangsu Province, China, with a focus on their ability to integrate climate action into the English curriculum. Data were gathered through a structured questionnaire designed to quantify these competencies. The questionnaire, adapted from a similar study by Lee et al. (2018) to ensure validity, was divided into two sections: one collecting basic demographic information and the other using a 4-point Likert scale to assess teachers' pedagogical content knowledge (PCK) related to climate change education. The scale ranged from "strongly disagree" to "strongly agree," enabling nuanced evaluation of the teachers' competencies.

The pilot study demonstrated a high internal consistency for the questionnaire items, with a Cronbach's Alpha value of 0.823, reflecting the robustness and reliability of the research data (Table 1).

Table 1 Cronbach Alpha

N of Items	*n*	Cronbach α
38	409	0.823

Additionally, the validity of the data was confirmed, evidenced by a Kaiser-Meyer-Olkin (KMO) value of 0.803, which indicates that the data are highly suitable for factor analysis (Table 2).

The target population included both urban and rural primary English teachers in Jiangsu Province. According to the Bureau of Statistics of Jiangsu Province, there are approximately 359,010 full-time primary school teachers in the province (Bureau of Statistics of Jiangsu Province, 2022). Using Krejcie and Morgan's (1970) formula, a sample size of 384 teachers was determined to be adequate, with an equal distribution of 192 teachers from urban and 192 from rural primary schools. Understanding the differences in competency between urban and rural teachers is crucial for improving educational quality (Wangmo et al., 2023).

The questionnaire was distributed online via the Questionnaire Star platform through WeChat, which facilitated easy access and ensured anonymity and voluntary participation. Initially, 400 questionnaires were planned to ensure a representative sample and data adequacy. However, the convenience of the online format led to an overachievement of this target, resulting in the collection of 409 completed questionnaires. Of these, 204 were from urban primary English teachers and 205 from rural teachers, significantly enhancing the reliability and accuracy of the analysis.

Data analysis was performed using SPSS (Statistical Package for the Social Sciences). Descriptive statistics were used to summarize demographic information and identify underlying trends, while an independent sample t-test compared the PCK levels between urban and rural teachers. This approach addressed the study's research questions and ensured a thorough analysis of the data.

The study adhered to stringent research ethics standards. Participants were informed about the study's purpose and methods, and their consent was obtained prior to participation. Measures were taken to ensure data integrity, including anonymizing responses to protect participant privacy, securing data access, and obtaining informed consent by clearly communicating the study's aims, procedures, and participants' rights. Participation was voluntary, with participants having the option to withdraw at any time without consequences.

Findings

The analysis of climate action integration competency among English teachers in urban and rural primary schools revealed several key findings in this study.

According to Table 2, the sample comprised 72.86% women. The largest age group was those aged 41–50 years, representing 27.87% of the sample with 114 individuals. Regarding teaching experience, the highest proportion of respondents had between 11 and 20 years of teaching experience, totaling 17.85% with 73 individuals. In terms of educational qualifications, 54.28% of the sample held a bachelor's degree, while 31.30% had a master's degree. The distribution of respondents was almost evenly split between rural and urban primary schools, with 50.12% teaching in rural schools and 49.88% in urban schools. Additionally, a significant majority, 89.98%, reported having participated in in-service training programs related to climate change education.

Table 2
Frequency

Items	Categories	N	Percent (%)	Cumulative Percent (%)
Gender	Female	298	72.86	72.86
	Male	111	27.14	100.00
Age	21-30	105	25.67	25.67
	31-40	99	24.21	49.88
	41-50	114	27.87	77.75
	51-60	80	19.56	97.31
	61 or more	11	2.69	100.00
	0-1year	40	9.78	9.78

Table 2
Frequency

Items	Categories	N	Percent (%)	Cumulative Percent (%)
How long have you been working as a lecturer	1-3 years	73	17.85	27.63
	10-15years	71	17.36	44.99
	15-20 years	50	12.22	57.21
	20-25 years	44	10.76	67.97
	25 years	40	9.78	77.75
	3-5 years	53	12.96	90.71
	5-10 years	38	9.29	100.00
Please indicate your level of education and major	Others / Major	22	5.38	5.38
	Doctor / Major	37	9.05	14.43
	Bachelor/Major	222	54.28	68.70
	Master / Major	128	31.30	100.00
Where do you work	Rural primary school	205	50.12	50.12
	Urban primary schools	204	49.88	100.00
Have you ever participated in any in-service training program on Education for climate change	No	41	10.02	10.02
	yes	368	89.98	100.00
Total		409	100.0	100.0

Descriptive Analysis

Descriptive analysis aims to summarize the overall situation of the data by examining measures of central tendency and dispersion (Fisher & Marshall, 2009). This study uses mean scores and standard deviations to provide an overview of the data, noting that no outliers were detected.

Table 4
Descriptive Analysis

Items	N of samples	Min	Max	Mean	Std. Deviation	Median
knowledge of subject matter	409	1.000	4.000	2.783	0.627	2.800
knowledge of the curriculum	409	1.000	4.000	2.785	0.624	2.750
Knowledge of learner	409	1.400	4.000	2.816	0.593	2.800
knowledge of instructional strategies	409	1.000	4.000	2.788	0.633	2.800
knowledge on Climate Change context in teaching English	409	1.000	4.000	2.750	0.608	2.667
Knowledge of educational goal	409	1.429	3.857	2.732	0.585	2.714
Knowledge of assessment	409	1.333	4.000	2.869	0.597	2.833

The mean score for knowledge of subject matter is 2.783, with a standard deviation of 0.627. This indicates that most sample scores are centered around 2.783, with a relatively narrow distribution. The mean score for knowledge of the curriculum is slightly higher at 2.785, with a standard deviation of 0.624. This suggests that curriculum knowledge scores are similarly concentrated but marginally higher compared to subject matter knowledge.

The highest mean score was observed for knowledge of learners, at 2.816, with a standard deviation of 0.593. This item has the highest mean score among all categories and the lowest standard deviation, indicating a more concentrated and less variable distribution of scores. The mean score for knowledge of instructional strategies is 2.788, with a standard deviation of 0.633. While the mean is comparable to that of subject matter and curriculum knowledge, the larger standard deviation indicates a slightly more dispersed score distribution.

For knowledge of the climate change context in teaching English, the mean score is 2.750, with a standard deviation of 0.608. This score is lower than that for knowledge of learners but higher than for knowledge of educational goals, with a standard deviation that falls between the values for instructional strategies and learner knowledge.

Knowledge of educational goals has the lowest mean score of 2.732, with a standard deviation of 0.585, indicating both a lower overall score and a relatively tight score distribution. Lastly, knowledge of assessment has a mean score of 2.869 and a standard deviation of 0.597. This score is high, just below that of knowledge of learners, with a moderate standard deviation, showing a fairly concentrated distribution of scores.

In summary, the mean scores for all items fall between 1 and 4, with knowledge of learners scoring the highest and knowledge of educational goals scoring the lowest. The standard deviations range from 0.585 to 0.633, indicating slight variations in score distributions across different categories.

Independent T-Test

The independent sample t-test was conducted to examine differences in the pedagogical content knowledge (PCK) of primary school English teachers across seven dimensions: knowledge of subject matter, curriculum, learners, instructional strategies, climate change context in teaching English, educational goals, and assessment. The analysis revealed statistically significant differences ($p < 0.05$) between teachers from urban and rural schools for each of these dimensions.

Table 5
Independent T-Test

	Where do you work (Mean±Std. Deviation)		*t*?	*p*?
	Urban primary school (*n*=204)	rural primary school (*n*=205)		
knowledge of subject matter	3.01(0.56)	2.56(0.61)	7.652	0.000*
knowledge of the curriculum	3.02(0.61)	2.55(0.54)	8.172	0.000*
knowledge of learner	3.00(0.55)	2.63(0.58)	6.512	0.000*
knowledge of instructional strategies	3.04(0.55)	2.53(0.60)	8.927	0.000*
knowledge on Climate Change context in teaching English	3.00(0.58)	2.51(0.54)	8.881	0.000*
Knowledge of educational goal	2.94(0.55)	2.52(0.54)	7.810	0.000*
Knowledge of assessment	3.11(0.55)	2.63(0.54)	8.923	0.000*
Overall	**3.02(0.57)**	**2.56（0.57）**	**8.13**	**0.000***

**** p<0.05***

In statistical terms, a P-value reported as 0.000 does not mean that the actual value is zero but rather indicates that the value is extremely small and rounded to zero when displayed with three decimal places. In this study, significance is denoted by asterisks: * for $p < 0.05$.
The mean values for urban primary school teachers were higher across all seven dimensions compared to their rural counterparts. This suggests that the teaching environment—urban versus rural—has a significant impact on teachers' PCK levels. The results indicate a notable disparity in teaching competency between primary school English teachers in urban and rural areas, with urban teachers generally exhibiting higher levels of PCK.

Discussion and Implications

The data analysis revealed a significant difference in the mean scores of pedagogical content knowledge (PCK) competencies between primary English teachers in urban and rural areas. Specifically, urban primary English teachers demonstrated higher competency in integrating climate action into their teaching compared to their rural counterparts. This disparity highlights the impact of resource availability, as urban areas generally provide better access to quality resources that enhance teachers' climate action integration capabilities.

The findings suggest that the urban-rural divide significantly affects the effectiveness of climate change education. Factors contributing to this difference include disparities in infrastructure and teaching resources, such as internet access and information and communication technology (ICT). Additionally, variations in work motivation and performance levels between urban and rural teachers play a crucial role. Sampelolo and Dominikus (2022), noted that lower work motivation negatively impacts teaching effectiveness. Rural teachers, who often face lower salaries and fewer opportunities for professional development, may experience reduced motivation, affecting their competency in integrating climate action.

This study provides valuable insights for regions with similar urban-rural economic and resource distribution gaps as Jiangsu. It confirms that differences in educational resources between urban and rural areas significantly impact teachers' competency in climate action integration. The results align with those of Nasim et al. (2024) and Luo et al. (2022), who found that disparities in educational resources lead to varying levels of competency among teachers, with urban teachers generally exhibiting higher competencies. However, this study's findings contrast with Kusin (2022), who reported no significant difference in teaching competency between urban and rural teachers. This discrepancy may be attributed to Kusin's smaller sample size, which could limit the generalizability of the results. Additionally, Kusin's mixed-methods approach, which combined both quantitative and qualitative data, might have influenced the findings differently compared to the purely quantitative approach used in this study.

Conclusion

This study compared and analyzed the climate action integration competency of primary English teachers in urban and rural areas of Jiangsu Province, China, using Pedagogical Content Knowledge (PCK) as a framework. The analysis revealed significant differences in climate action integration competencies between urban and rural teachers. Urban teachers consistently scored higher across all seven dimensions of PCK, attributed to their access to superior educational resources compared to their rural counterparts. This disparity underscores the need for targeted interventions to address the gaps in climate action integration competency.

To bridge this gap, the study recommends that the Jiangsu Provincial Government and the Jiangsu Provincial Education Bureau prioritize professional development programs focused on climate change education for both urban and rural teachers. Efforts should be directed towards equipping rural schools with state-of-the-art teaching and learning tools, including advanced multimedia equipment. This would enable rural teachers to leverage multimedia

teaching methods and enhance their competency in integrating climate action into their curriculum, thereby improving the effectiveness of climate change education.

Additionally, incentive policies should be developed to encourage and support skilled teachers from urban areas to serve in rural schools, helping to balance the distribution of teacher resources. Such policies aim to elevate the climate action integration competency of rural teachers to match their urban counterparts. Beyond these governmental measures, rural teachers should actively engage in climate literacy training programs, conduct regular self-assessments, and continually enhance their PCK related to climate change.

Addressing these competency differences through targeted initiatives is crucial for achieving equitable and effective climate change education. By focusing on these areas, the overall quality of climate change education can be improved, preparing future students to be more resilient to climate challenges.

This study has several limitations that should be acknowledged. Firstly, the geographical scope of the research, focusing exclusively on primary English teachers in Jiangsu Province, may limit the generalizability of the findings. Future research should expand to include a broader range of regions to provide a more comprehensive understanding of climate action integration across diverse contexts.

Secondly, the study's reliance on quantitative methods alone restricts the ability to capture the nuanced challenges faced by teachers in implementing climate change education. To address this, future research could benefit from incorporating qualitative approaches, such as interviews and classroom observations. These methods would offer deeper insights into the specific difficulties and practices of teachers, thereby enhancing the assessment of climate action competency differences between urban and rural primary school teachers.

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