Journal of Science and Mathematics Education
Vol. 1 No. 4, December 2025, pp. 118-124
E-ISSN 3090-0336

JOSME
Journal of Science and Mathematics Education

Teachers' Readiness and Attitudes Toward the Implementation of Climate Change Education in Southeast Asia

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ARTICLE INFO

Article history
Received : September 30, 2025
Revised : October 26, 2025
Accepted : December 26, 2025
Published: December 28, 2025

Keywords
Climate Change Education
Teacher Readiness
Teacher Attitudes
Southeast Asia
Environmental Education

ABSTRACT

The escalating impacts of climate change have underscored the urgent need for integrating Climate Change Education (CCE) into school curricula, particularly in vulnerable regions such as Southeast Asia. This study explores the readiness and attitudes of teachers across selected Southeast Asian countries toward the implementation of CCE in formal education. Utilizing a mixed-methods approach, the research surveyed 350 teachers from Indonesia, Malaysia, Thailand, and the Philippines, and conducted in-depth interviews with 20 educators. The findings reveal a moderate level of readiness among teachers, primarily influenced by institutional support, availability of resources, and prior training. Attitudinally, the majority of respondents expressed a positive outlook on the integration of CCE, recognizing its importance in fostering environmental awareness and sustainable behavior among students. However, significant barriers were identified, including lack of professional development programs, insufficient instructional materials, and curriculum constraints. The study highlights the necessity of multi-stakeholder collaboration involving governments, educational institutions, and NGOs to develop structured training programs and supportive policies. By identifying the current gaps and opportunities, the research provides actionable insights for policy-makers and educational planners aiming to strengthen the role of teachers in combating climate change through education. Enhancing teacher capacity is crucial for cultivating a climate-literate generation prepared to face environmental challenges in the region.

How to cite: Jaelani, A., Djayaningrat,D W. (2025). Teachers' Readiness and Attitudes Toward the Implementation of Climate Change Education in Southeast Asia, *1*(4). 118-124. https://doi.org/10.70716/josme.v1i4.339

INTRODUCTION

Climate change poses one of the most profound and complex challenges of the 21st century, influencing every aspect of life including health, economy, biodiversity, and social stability (IPCC, 2022). Its impacts are not evenly distributed, with developing regions such as Southeast Asia facing disproportionate consequences due to geographic, economic, and infrastructural vulnerabilities (Yusuf & Francisco, 2009). As such, equipping populations with the knowledge and skills to respond to these challenges through Climate Change Education (CCE) has become an educational and societal imperative (Anderson, 2012). Education systems play a critical role in cultivating climate-conscious citizens who can engage in sustainable practices and advocate for environmental protection (Monroe et al., 2017).

Climate Change Education, as recognized in the United Nations Framework Convention on Climate Change (UNFCCC) and UNESCO's global action programs, aims not only to increase awareness but also to drive behavioral change and policy engagement (UNESCO, 2021). Within this context, teachers are central agents of change who mediate curriculum, pedagogical practices, and student understanding (Anderson, 2012; Boeve-de Pauw et al., 2015). Their readiness and attitudes toward integrating CCE are thus critical to the effectiveness of education-based climate interventions (Shepardson et al., 2011). However, limited attention has been paid to how prepared and willing teachers are to implement CCE, particularly in regions such as Southeast Asia.

The Southeast Asian region is particularly vulnerable to climate-related disasters including rising sea levels, extreme weather events, and ecological degradation (Hijioka et al., 2014). Consequently, the urgency for climate literacy in this region is pressing. Nevertheless, the implementation of CCE remains inconsistent across countries, hindered by differences in educational policies, teacher training infrastructures, and resource allocation (Chang & Pascua, 2017). Despite various national education strategies referencing climate change, integration into teaching practices remains fragmented and often superficial (Bencze et al., 2022).

Teachers' readiness—defined as their knowledge, skills, confidence, and institutional support to deliver CCE—is a vital component of effective implementation (Evans et al., 2017). Studies have shown that teachers who have received training in environmental or sustainability education demonstrate greater efficacy in facilitating climate-related learning (Anderson, 2012; Monroe et al., 2019). However, readiness is not only a function of knowledge and training but also of access to curriculum guidelines, appropriate pedagogical tools, and support from school leadership (Stevenson et al., 2017).

Attitudes, on the other hand, encompass teachers' beliefs, values, and perceived responsibilities regarding climate education. Positive attitudes often correlate with proactive engagement in CCE (Lee et al., 2007). Teachers who perceive climate change as an urgent and teachable topic are more likely to incorporate it meaningfully in their instruction (Mead et al., 2012). Conversely, when teachers perceive climate change as politically sensitive or beyond their subject scope, they may avoid or minimize its inclusion (Plutzer et al., 2016).

In many Southeast Asian countries, there is a lack of systemic support for professional development programs focused on climate education (Barwell et al., 2021). Consequently, teachers often rely on informal sources or outdated materials, limiting the accuracy and relevance of the information delivered to students (Azeiteiro et al., 2015). Moreover, time constraints, rigid curricula, and examination-oriented systems further impede the inclusion of interdisciplinary topics such as CCE (Bartoszewski & Huggins, 2020).

Existing research has largely focused on CCE implementation at the policy or curriculum level, with less attention to teacher-level factors such as perceptions, readiness, and practical constraints (Kagawa & Selby, 2010). Yet it is precisely at the classroom level that the transformation of climate knowledge into meaningful understanding occurs. Teachers serve as the linchpin between policy and practice; their attitudes and capacities directly influence whether CCE translates into empowered student action or remains a theoretical abstraction (Pizmony-Levy & Asif, 2019).

The social-cultural context of Southeast Asia adds further complexity. Variations in political will, educational governance, and socio-economic development mean that a one-size-fits-all approach to CCE is ineffective (Rieckmann, 2018). In some countries, climate change education is embedded within environmental science, while in others, it is relegated to extracurricular activities or non-compulsory topics (Leicht et al., 2018). These disparities necessitate an in-depth understanding of the specific conditions and perceptions of teachers within the region.

Furthermore, language barriers and the lack of localized educational resources often limit the accessibility of CCE content (Tran et al., 2020). Teachers may find it challenging to adapt international materials to local contexts, leading to disengagement or misconceptions among students (Wals et al., 2014). Thus, assessing teacher readiness must also account for the availability and cultural appropriateness of teaching materials.

Technological advancements offer new opportunities to enhance teacher capacity through online training modules, digital toolkits, and international knowledge exchange (de los Rios et al., 2021). Nevertheless, disparities in digital access and competencies persist across rural and urban school systems in Southeast Asia (Sumarni et al., 2022). These gaps reinforce the importance of multi-level interventions that combine technological innovation with foundational support structures.

The emotional dimension of CCE is also gaining recognition. Teachers may experience anxiety or helplessness when addressing climate change, particularly when faced with student concerns or local environmental crises (Ojala, 2015). Without adequate psychological support and pedagogical strategies, these emotional burdens can undermine teacher effectiveness and willingness to engage with climate content (Stevenson et al., 2017).

To date, empirical studies specifically investigating Southeast Asian teachers' readiness and attitudes toward CCE remain limited. Comparative research is especially scarce, resulting in a fragmented understanding of regional trends and shared challenges (Tilbury, 2011). This study seeks to address this gap by examining both the cognitive (readiness) and affective (attitudinal) dimensions of teacher engagement with CCE across Indonesia, Malaysia, Thailand, and the Philippines.

By utilizing a mixed-methods approach, this research not only captures quantitative trends but also explores qualitative insights from in-depth interviews with teachers. This dual perspective enables a nuanced analysis of the structural and personal factors influencing CCE implementation (Bryman, 2012). The findings

can inform policymakers, educational planners, and NGOs aiming to develop targeted interventions that enhance teacher capacity in climate education.

Ultimately, this study underscores the critical role of teachers as change agents in the fight against climate change. Building their capacity, improving their working conditions, and respecting their professional judgment are essential to nurturing a climate-literate generation capable of safeguarding Southeast Asia's ecological and social future (Mochizuki & Bryan, 2015). The next sections present the methodology and findings of this cross-national study.

RESEARCH METHODOLOGY

This study adopted a mixed-methods research design, integrating both quantitative and qualitative approaches to provide a comprehensive understanding of teachers' readiness and attitudes toward the implementation of Climate Change Education (CCE) in Southeast Asia. The rationale for this design lies in the complexity of the research objectives, which required the measurement of observable trends as well as an in-depth exploration of personal experiences and contextual influences. The quantitative component was used to capture general patterns and levels of readiness and attitudes across a large sample, while the qualitative component served to contextualize and deepen these findings through nuanced teacher narratives.

The quantitative phase of the study involved the administration of a structured questionnaire to a total of 350 teachers across four Southeast Asian countries: Indonesia, Malaysia, Thailand, and the Philippines. A multistage sampling technique was employed to ensure national, regional, and school-level representation, including both urban and rural school settings. The instrument included five main sections: demographic background, knowledge of climate change concepts, pedagogical readiness, institutional support, and attitudinal orientation toward CCE. Each item was measured using a 5-point Likert scale ranging from "strongly disagree" to "strongly agree." The reliability of the instrument was tested using Cronbach's alpha, yielding coefficients above 0.80 for all constructs, indicating high internal consistency.

In the qualitative phase, semi-structured interviews were conducted with 20 teachers selected from the survey respondents, representing diverse backgrounds in terms of teaching experience, subject specialization, school type, and geographic location. The interview guide focused on four thematic areas: perceptions of climate change, experiences in teaching CCE, perceived institutional and systemic barriers, and personal motivations or concerns. Interviews were conducted in local languages with the aid of bilingual research assistants and subsequently translated into English. Thematic analysis was conducted using NVivo software, following Braun and Clarke's six-step framework to identify recurring patterns and deeper insights related to readiness and attitude formation.

Data analysis for the quantitative component was carried out using SPSS software. Descriptive statistics (mean, standard deviation, frequency) were used to summarize teacher readiness and attitude levels. Inferential analyses, including ANOVA and regression modeling, were employed to test relationships between demographic variables (e.g., years of teaching, subject area, training received) and dependent variables (readiness and attitude). These statistical tests were crucial in identifying significant predictors of teacher preparedness and willingness to integrate CCE across educational contexts.

To ensure validity and reliability, the study followed several quality assurance procedures. The research instruments were piloted with a sample of 30 teachers in Indonesia and refined based on their feedback. Triangulation between quantitative and qualitative findings was employed to enhance the credibility of interpretations. Member checking was also utilized, wherein a subset of interviewees reviewed the researchers' preliminary interpretations to confirm accuracy. Ethical clearance was obtained from relevant institutional review boards, and informed consent was secured from all participants. Confidentiality and anonymity were maintained throughout the research process.

Overall, the mixed-methods approach allowed for a robust exploration of the complex interplay between teachers' knowledge, beliefs, institutional environments, and pedagogical behaviors. By capturing both breadth and depth of data, this methodology enabled the research to move beyond surface-level trends and contribute empirically grounded insights into the current state and future potential of climate change education in Southeast Asia.

RESULTS AND DISCUSSION

The integration of Climate Change Education (CCE) into the educational systems of Southeast Asia presents both challenges and opportunities for policy development. The findings from this study reveal that teachers across Indonesia, Malaysia, Thailand, and the Philippines generally exhibit positive attitudes toward CCE but face significant barriers that hinder its effective implementation. These barriers include insufficient professional development opportunities, limited resources, and a lack of clear policy guidelines on integrating CCE into national curricula. A crucial issue that needs further attention is the disconnect between teacher readiness and the national educational policies in each of the countries. The findings suggest that while teachers recognize the importance of climate change education, there is a clear gap between their preparedness to teach the subject and the level of institutional support provided by their respective governments (Boeve-de Pauw et al., 2015; Evans et al., 2017).

To address these issues effectively, the relationship between the research findings and national education policies must be explored in greater depth. This study indicates that teachers' readiness to implement CCE is influenced by various factors, including prior training, institutional support, and the availability of teaching materials. However, these factors often reflect the limitations of the broader educational policy frameworks in place in each country. While some countries, such as Indonesia, have made strides in integrating environmental education into their curricula (Chang & Pascua, 2017), the lack of standardized guidelines and practical support for teachers means that CCE often remains an optional, peripheral topic. In other countries, like the Philippines and Malaysia, where environmental issues are acknowledged in national education goals, the actual incorporation of these topics into classroom instruction is inconsistent and fragmented (Leicht et al., 2018; Rieckmann, 2018).

The findings suggest that a more contextualized analysis of national policies is necessary. This analysis should address how current policies on climate change education are being implemented in schools and identify the specific challenges that teachers face. In particular, the study highlights the need for policy reforms that not only prioritize environmental education in the curriculum but also provide practical guidelines and structured support to teachers at the school level (Monroe et al., 2017). For example, while governments may endorse climate change education, the lack of a clear mandate on how to teach it or a consistent approach to integrating climate change topics across subjects is a significant obstacle (Kagawa & Selby, 2010; Tilbury, 2011). Therefore, the implementation of CCE policies should not only focus on the inclusion of climate change in curricula but also on the professional development of teachers who will be responsible for delivering this content (Pizmony-Levy & Asif, 2019).

Teacher Readiness and National Policy Gaps

The study found that teachers in Southeast Asia exhibit a moderate level of readiness to implement CCE. However, the gap between their readiness and the policies of their respective educational systems is striking. Teachers with formal training in environmental science or sustainability education reported higher confidence in teaching climate-related topics, while those without such training expressed uncertainty and anxiety about incorporating these subjects into their lessons (Anderson, 2012; Evans et al., 2017). This disparity reflects a significant gap in teacher preparedness that is not fully addressed by current educational policies. Governments must recognize that CCE cannot be implemented effectively without substantial investments in teacher training that focus on both content knowledge and pedagogical skills (Azeiteiro et al., 2015).

Moreover, while the national policies in these countries acknowledge the importance of environmental education, there is a lack of coherent and enforceable guidelines for the implementation of CCE at the school level. In Indonesia, for example, while environmental education is included in the national curriculum, the integration of climate change topics into specific subjects remains ad hoc (Bencze et al., 2022). Similarly, in Malaysia, CCE is often relegated to extracurricular activities rather than being a part of the formal curriculum (Monroe et al., 2019). This fragmented approach to CCE implementation means that even though the policies exist, their application at the school level is inconsistent, leading to a lack of clarity and effectiveness in teaching climate change concepts (Kagawa & Selby, 2010).

One key issue raised in this study is the need for a standardized approach to CCE implementation that takes into account the specific challenges faced by teachers in different countries and regions. The findings suggest that policies should not adopt a one-size-fits-all approach. Instead, they must be tailored to the unique needs of each country's educational system, taking into account factors such as the local

environmental context, available resources, and the level of teacher expertise (Lee et al., 2013). For example, while urban teachers may have better access to resources and training opportunities, rural teachers face challenges related to limited access to professional development programs and teaching materials (Wals et al., 2014). Therefore, national education policies must consider these disparities and provide targeted support to teachers in both urban and rural settings (Stevenson et al., 2017).

Barriers to Effective CCE Implementation

Several barriers to the effective implementation of CCE were identified in this study, with institutional support and resource constraints being the most prominent. The findings indicate that teachers who received strong institutional support, such as professional development opportunities and curriculum guidelines, were more confident in teaching climate change concepts. In contrast, those who lacked institutional support often relied on outdated or unofficial materials, limiting the quality of climate change education they could provide. This disparity underscores the importance of systemic support for CCE, which should include not only curriculum reforms but also substantial investments in teacher training and the provision of appropriate teaching materials (Boeve-de Pauw et al., 2015; Stevenson et al., 2017).

In addition to institutional support, resource constraints emerged as a significant barrier to CCE implementation. Teachers in rural areas, in particular, reported having limited access to teaching materials and digital resources that could support the delivery of climate change content. This lack of resources hampers the ability of teachers to engage students effectively with the topic of climate change (Sumarni et al., 2022). In many cases, teachers were forced to rely on self-created materials or online sources, which may not always be reliable or relevant to the local context (Barwell et al., 2021). This issue points to the need for government action to ensure that all schools, regardless of location, have access to high-quality, localized teaching materials that are specifically designed to address the challenges of climate change education (de los Rios et al., 2021).

Furthermore, the study revealed that curriculum constraints were a significant factor hindering the integration of CCE into the classroom. Teachers reported that the rigid, exam-oriented nature of many national curricula made it difficult to find space for interdisciplinary topics like CCE. In countries like Thailand and Malaysia, where the focus is often on preparing students for standardized tests, teachers are under pressure to prioritize subjects that are directly tested. This creates a disconnect between the national education priorities and the actual needs of students, who must be equipped with the skills and knowledge necessary to address the pressing challenges of climate change (Ojala, 2015; Pizmony-Levy & Asif, 2019).

The Role of Policy Reforms and Teacher Empowerment

The findings of this study highlight the critical role of policy reforms in addressing the gaps and barriers identified in the implementation of CCE. To make CCE more effective, it is crucial for governments to take concrete steps to align national policies with the needs of teachers and students. The study suggests that one of the most effective ways to do this is through teacher empowerment. This can be achieved by offering targeted professional development programs that focus not only on climate science but also on teaching strategies that can engage students with complex environmental issues (Anderson, 2012; de los Rios et al., 2021). Teachers must be given the tools and confidence to teach CCE effectively, which will require sustained investment in training and institutional support (Monroe et al., 2019).

Moreover, national education policies should provide clear, standardized guidelines for the integration of CCE into curricula, ensuring that it is treated as a core subject rather than a peripheral topic. The study suggests that CCE should be incorporated across various subjects, not just within science or environmental studies, to ensure that students receive a holistic understanding of climate change and its impact on society (Wals et al., 2014). To achieve this, governments should collaborate with educational institutions, NGOs, and climate experts to develop a curriculum that is not only scientifically accurate but also culturally relevant to local contexts (Rieckmann, 2018).

Finally, collaboration between stakeholders, including government agencies, teachers, and NGOs, is essential for the successful implementation of CCE. Teachers who are part of professional learning communities or networks that focus on environmental education tend to exhibit higher levels of motivation and competence in teaching CCE (Lee et al., 2013). Governments should support the creation of these communities, as they offer teachers opportunities to share resources, collaborate on projects, and exchange ideas on how to overcome the challenges of CCE implementation (Susanti, 2019).

CONCLUSION

The study's findings underscore the critical need for policy reforms that address the gaps and barriers to effective CCE implementation in Southeast Asia. Although teachers across the region demonstrate positive attitudes toward CCE, their ability to effectively teach the subject is hindered by a lack of institutional support, limited resources, and fragmented curricula. To bridge this gap, governments must prioritize CCE as a core subject within national curricula, provide targeted professional development programs for teachers, and ensure the availability of localized teaching materials. By doing so, they can empower educators to foster a climate-literate generation capable of addressing the challenges posed by climate change.

In addition, further research is needed to explore the long-term impacts of CCE on students' environmental awareness and behavior, as well as the role of teacher agency in driving curriculum change. Only through comprehensive and context-specific interventions can Southeast Asia build a robust educational framework that equips students with the knowledge and skills needed to navigate the complexities of the climate crisis.

REFERENCES

Anderson, A. (2012). Climate change education for mitigation and adaptation. *Journal of Education for Sustainable Development*, 6(2), 191–206.

Azeiteiro, U. M., Bacelar-Nicolau, P., Caetano, F. J., & Caeiro, S. (2015). Education for sustainable development through e-learning in higher education: Experiences from Portugal. *Journal of Cleaner Production*, 106, 308–319.

Barwell, R., Petrou, M., & Inglis, M. (2021). *Educating future citizens in a changing climate: The role of teacher education*. Teaching and Teacher Education, 106, 103456.

Bartoszewski, S., & Huggins, R. (2020). Obstacles to teaching climate change in schools. *International Journal of Environmental & Science Education*, 15(1), 45–62.

Bencze, J. L., Sperling, E. R., & Carter, L. (2022). *Teaching controversial socioscientific issues in science education*. Science Education, 106(3), 489–517.

Boeve-de Pauw, J., Gericke, N., Olsson, D., & Berglund, T. (2015). *The effectiveness of education for sustainable development*. Environmental Education Research, 21(7), 955–970.

Bryman, A. (2012). *Social Research Methods* (4th ed.). Oxford University Press.

Chang, C. H., & Pascua, L. (2017). Singapore and Philippines: A comparison of sustainability in education. *Asia Pacific Journal of Education*, 37(4), 487–502.

de los Rios, C., Lopez, J., & Brown, T. (2021). *Virtual education and climate change: Opportunities and challenges*. Sustainability, 13(2), 578.

Evans, N., Stevenson, R., Lasen, M., Ferreira, J. A., & Davis, J. (2017). *Approaches to embedding sustainability in teacher education*. Environmental Education Research, 23(1), 111–128.

Hijioka, Y., Lin, E., Pereira, J. J., Corlett, R. T., Cui, X., Insarov, G., ... & Surjan, A. (2014). Asia. In *Climate Change 2014: Impacts, Adaptation, and Vulnerability* (pp. 1327–1370). IPCC.

IPCC. (2022). *Sixth Assessment Report*. Intergovernmental Panel on Climate Change.

Kagawa, F., & Selby, D. (2010). *Climate change education: A critical agenda*. Policy & Practice: A Development Education Review, 10, 5–15.

Lee, O., Quinn, H., & Valdés, G. (2013). *Science and language for English language learners in relation to Next Generation Science Standards.* Educational Researcher, 42(4), 223–233.

Leicht, A., Heiss, J., & Byun, W. J. (2018). *Issues and trends in education for sustainable development*. UNESCO.

Mead, R., Armstrong, J., & Parise, J. (2012). Attitudes and beliefs about climate change: Teaching science as science. *Journal of Geoscience Education*, 60(2), 178–183.

Monroe, M. C., Plate, R. R., Oxarart, A., Bowers, A., & Chaves, W. A. (2019). *Identifying effective climate change education strategies: A systematic review*. Environmental Education Research, 25(6), 791–812.

Ojala, M. (2015). Climate change skepticism among adolescents. *Journal of Environmental Psychology*, 42, 104–112.

Pizmony-Levy, O., & Asif, E. (2019). *Teachers' support for climate change education*. Environmental Education Research, 25(5), 623–637.

Plutzer, E., McCaffrey, M., Hannah, A. L., Rosenau, J., Berbeco, M., & Reid, A. H. (2016). *Climate confusion among U.S. teachers*. Science, 351(6274), 664–665.

Rieckmann, M. (2018). Learning to transform the world: *Key competencies in Education for Sustainable Development*. Issues and Trends in Education for Sustainable Development, 39–59.

Stevenson, R. B., Brody, M., Dillon, J., & Wals, A. E. J. (2017). *International Handbook of Environmental Education*. Routledge.

Sumarmi, S., Ruja, I. N., & Utomo, D. H. (2022). ICT and environmental education: Gaps in implementation in Indonesian schools. *International Journal of Instruction*, 15(1), 115–128.

Tran, T. D., Nguyen, M. H., & Pham, L. T. (2020). *Language barriers in climate change education: The Vietnamese experience*. Environmental Education Research, 26(8), 1173–1186.

UNESCO. (2021). *Learn for our planet: A global review of how environmental issues are integrated in education*. UNESCO Publishing.