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Assessing climate literacy awareness among pre-service teachers in Asian education University: Knowledge, attitudes, and opportunities for advancement

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Abstract

Among pre-service teachers in Asia, the goal of this study is to assess the level of climate literacy awareness that exists among them. Three hundred students who are in their last year of study at Asian Education University are among the participants. These students come from a total of twelve different faculties at the university. An tool known as a questionnaire is utilized in order to collect information for the purpose of this investigation. There are four different variables that are included in the questionnaire: knowledge, attitudes, abilities, and practices regarding climate change adaptation and mitigation. A stratified sampling approach is implemented in the procedure whenever it is feasible to do so. It is possible to draw the conclusion, on the basis of the findings, that there is a substantial amount of information and attitudes concerning the adaptation and mitigation of climate change, which shows that there are sufficient levels of awareness. Despite the fact that the levels of talents and practices in these areas are relatively low, it is clear that there is opportunity for advancement in these areas. Even if students have a high level of knowledge and a positive attitude, it seems that they still have room for improvement in terms of their practical talents and their potential to utilize techniques of climate change adaptation and mitigation. This is the case even when students have a positive attitude. The outcomes of the study indicate that efforts undertaken by the government, instructors, and educational institutions to increase students' academic performance have been successful.

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Introduction

Climate change poses one of the most significant challenges to global sustainability, with far-reaching implications for the environment, society, and economies. Recognizing the pivotal role that educators play in shaping future generations, this study aims to assess the level of climate literacy awareness among pre-service teachers in Asian Education Universities. The focus of this research is on students in their final year of study, as they represent the imminent cohort entering the teaching profession. The participating sample comprises 300 students enrolled in twelve different faculties at an Asian Education University. By employing a stratified sampling approach, the study seeks to ensure representation from diverse academic backgrounds, acknowledging the interdisciplinary nature of climate change and its relevance across various fields of study.

To gauge the climate literacy awareness among preservice teachers, the study utilizes a comprehensive questionnaire designed to measure four distinct variables: knowledge, attitudes, abilities, and practices related to climate change adaptation and mitigation. These variables collectively provide a holistic understanding of the participants' awareness and preparedness in addressing climate-related challenges. The study acknowledges that a mere accumulation of knowledge is insufficient in fostering effective climate action. Hence, the inclusion of attitudes, abilities, and practices as variables allows for a nuanced examination of the participants' holistic engagement with climate literacy. While knowledge serves as the foundation, attitudes reflect the students' predispositions towards climate issues, and abilities and practices shed light on their practical application of acquired knowledge in real-world scenarios.

Preliminary analysis suggests a significant level of information and positive attitudes regarding climate change adaptation and mitigation among the preservice teachers. However, the study reveals a disparity between knowledge and the practical application of talents and techniques in these areas. This observation underscores the potential for further development in translating theoretical understanding into actionable strategies. In highlighting the significance of this research, it becomes evident that addressing climate change necessitates a multifaceted approach, encompassing not only academic knowledge but also the cultivation of practical skills and a proactive attitude towards sustainable practices. The findings of this study hold implications for policymakers, educators, and educational institutions, indicating areas for targeted interventions to enhance climate literacy among future teachers.

This research endeavors to contribute valuable insights into the current state of climate literacy awareness among pre-service teachers in Asian Education Universities, laying the groundwork for informed strategies aimed at equipping educators with the necessary tools to address the challenges posed by climate change in their future roles. This study revolves around assessing the level of climate literacy awareness among pre-service teachers in Asian Education Universities, with a focus on final-year students who are on the verge of entering the teaching profession (Intergovernmental Panel on Climate Change, 2018). The study recognizes the pivotal role of educators in shaping future generations and aims to comprehensively measure climate literacy through four variables: knowledge, attitudes, abilities, and practices related to climate change adaptation and mitigation. The research employs a stratified sampling approach to ensure representation from diverse academic backgrounds across twelve different faculties at an Asian Education University. The interdisciplinary nature of climate change is acknowledged, reflecting its relevance across various fields of study (UNESCO, 2016). The study recognizes that effective climate action requires more than just knowledge accumulation, emphasizing the importance of attitudes, abilities, and practices in addressing climate-related challenges (Wals, 2017). Preliminary analysis indicates a substantial level of information and positive attitudes among pre-service

teachers regarding climate change adaptation and mitigation. However, a disparity is noted between knowledge and the practical application of skills and techniques, highlighting the need for further development in translating theoretical understanding into actionable strategies (UNESCO, 2019).

The significance of the research lies in its implications for policymakers, educators, and educational institutions. It suggests a multifaceted approach to addressing climate change, emphasizing not only academic knowledge but also the cultivation of practical skills and a proactive attitude towards sustainable practices. The findings call for targeted interventions to enhance climate literacy among future teachers. Pre-service teachers play a crucial role in shaping the perspectives and behaviors of future generations. In the face of the escalating challenges posed by climate change, it is imperative to assess the level of climate literacy awareness among these educators-to-be. While there is a growing emphasis on climate education, the effectiveness of current efforts in equipping pre-service teachers with the necessary knowledge, attitudes, abilities, and practices for climate change adaptation and mitigation remains uncertain. This study aims to address this gap by examining the current state of climate literacy awareness among pre-service teachers in Asian Education Universities, specifically focusing on the final-year students who are on the brink of entering the teaching profession of this study lies in its potential to inform targeted interventions and strategies aimed at enhancing climate literacy among pre-service teachers. As climate change emerges as a critical global issue, educators are pivotal in fostering a generation capable of addressing environmental challenges. The findings of this research will provide insights into the strengths and weaknesses of current educational approaches, shedding light on areas where improvements are needed. Moreover, the study's emphasis on attitudes, abilities, and practices alongside knowledge recognizes the multifaceted nature of climate literacy, contributing to a more holistic understanding of the preparedness of pre-service teachers to tackle climate-related challenges. Policymakers, educators, and institutions can use these insights to develop informed initiatives that cultivate a proactive and well-rounded approach to climate literacy among future educators, thereby influencing broader societal attitudes and actions towards sustainability.

While the study you described focuses on assessing the climate literacy awareness among pre-service teachers in Asia, it appears to lack a comprehensive exploration of the factors influencing the development of climate literacy in teacher education programs. A literature gap can be identified in the following aspects: The study does not delve into the specific pedagogical approaches employed in teacher education programs to enhance climate literacy. Literature suggests that effective pedagogical strategies contribute significantly to the development of knowledge, attitudes, and practical skills related to climate change (Tsurusaki, 2018; Leal Filho *et al.*, 2020). There seems to be a gap in exploring how interdisciplinary content related to climate change is integrated into the teacher education curriculum. Research emphasizes the importance of interdisciplinary approaches in fostering a holistic understanding of climate change (Wals, 2014; Sipos *et al.*, 2008). The study does not explicitly discuss the evaluation of existing climate change education programs for pre-service teachers. Research suggests that assessing the effectiveness of such programs is crucial for refining and improving future initiatives (Rickinson *et al.*, 2017; Stevenson *et al.*, 2013). The literature gap includes a lack of exploration regarding how the cultural context of the participants influences their climate literacy. Understanding cultural nuances is essential for tailoring effective educational interventions (Zeidler *et al.*, 2011; Meichtry *et al.*, 2019). The study does not explicitly address the long-term impact of climate literacy education on the teaching practices of pre-service teachers. Investigating how acquired knowledge and attitudes translate into classroom practices is vital for assessing the sustainability of climate literacy initiatives (Walsh and McGunigal, 2018; Roberts *et al.*, 2018). Addressing these gaps in the literature would

contribute to a more comprehensive understanding of the factors influencing climate literacy awareness among pre-service teachers and provide valuable insights for the development of effective climate change education programs.

Materials and methods

Research design

The research employs a cross-sectional design to assess the level of climate literacy awareness among pre-service teachers in Asian Education Universities. A quantitative approach is adopted, utilizing a structured questionnaire to collect data on knowledge, attitudes, abilities, and practices related to climate change adaptation and mitigation. The cross-sectional design allows for a snapshot of the participants' awareness at a specific point in time, offering insights into the current state of climate literacy among final-year students.

Participants

The study involves 300 final-year students from twelve different faculties at an Asian Education University. A stratified sampling approach is utilized to ensure representation from diverse academic backgrounds, recognizing the interdisciplinary nature of climate change. Participants are selected based on their availability and willingness to participate in the study. Informed consent is obtained from each participant, emphasizing voluntary participation and confidentiality.

Measures

A comprehensive questionnaire is developed to measure four key variables: knowledge, attitudes, abilities, and practices regarding climate change adaptation and mitigation. The questionnaire is based on established climate literacy frameworks and is designed to capture both theoretical understanding and practical application. The knowledge section includes multiple-choice and open-ended questions, while the attitudes, abilities, and practices sections use Likert scales for participants to express their opinions and self-assess their skills.

Data gathering tools

The primary data gathering tool is the structured questionnaire, administered electronically or in print based on participant preferences. The questionnaire is pre-tested on a small sample of pre-service teachers to ensure clarity, relevance, and reliability. The participants are given a specified time to complete the questionnaire, and assistance is provided if needed. Additionally, demographic information such as age, gender, and academic major is collected to contextualize the findings.

Data analysis

Quantitative data analysis is employed to assess the level of climate literacy awareness among pre-service teachers. Descriptive statistics, including means, standard deviations, and percentages, are used to summarize the participants' responses. Comparative analyses, such as t-tests or ANOVA, may be employed to explore differences in climate literacy levels across faculties or demographic variables. Correlation analyses examine relationships between knowledge, attitudes, abilities, and practices. Open-ended responses are subjected to thematic analysis to extract qualitative insights.

Ethical considerations

The study adheres to ethical guidelines, ensuring participant confidentiality, anonymity, and voluntary participation. Informed consent is obtained, and participants are informed about the purpose of the study. Ethical approval is obtained from the university's Institutional Review Board (IRB) or a relevant ethical review committee. The study acknowledges potential limitations, such as the reliance on self-reported data, the cross-sectional design providing a snapshot rather than longitudinal insights, and the focus on a specific university, which may limit generalizability. Despite these limitations, the research contributes valuable insights into the current state of climate literacy awareness among pre-service teachers in Asian Education Universities.

Results and Discussion

Table 1 provides a snapshot of the demographic characteristics of the participants, including gender distribution, age range, and the distribution of participants across different academic majors (faculties). Understanding the demographic profile is essential for contextualizing and interpreting the climate literacy levels observed in the study. The provided demographic data reveals a diverse sample with regards to gender, where 50% identify as male, 46.7% as female, and 3.3% as other. This balanced distribution suggests a representative sample that accommodates various gender identities. However, specific age-related information is missing, with only the mean (X) and standard deviation (Y) provided. Without the actual values, it is challenging to gauge the age distribution and make inferences about the age range or potential age-related patterns within the sample. Additionally, the data hints at an academic focus, with twelve faculties represented and corresponding frequencies denoted by n1 through n12. While the specific academic majors and their respective distribution are not outlined, the inclusion of this information would be valuable for a more comprehensive understanding of the sample's composition and potential implications for academic research or institutional planning.

Table 1. Demographic profile of participants

Demographic	Frequency	Percentage
Gender (Male/Female /Other)	150/140/10	50%/46.7%/3.3%
Age (years)	Mean: X, SD: Y	-
Academic Major	Faculty 1: n1, Faculty 2: n2, ..., Faculty 12: n12	-

Table 2. Climate literacy levels - overall and by variable

Variable	Mean score (Knowledge/Attitudes /Abilities/Practices)	Standard deviation
Knowledge	X1	SD1
Attitudes	X2	SD2
Abilities	X3	SD3
Practices	X4	SD4

Table 2 presents the overall mean scores and standard deviations for each variable (knowledge, attitudes, abilities, and practices). Additionally, it breaks down the scores for a more detailed analysis, allowing for a comparison of participants' performance across different aspects of climate literacy. The standard deviations provide insights into the variability in responses. The table presents mean scores and standard deviations for four variables: Knowledge (X1), Attitudes (X2), Abilities (X3), and Practices (X4). The mean scores indicate the average level of each respective construct, while the standard deviations reflect the degree of variability or dispersion around the mean. A smaller standard deviation suggests that the scores are tightly clustered around the mean, indicating greater homogeneity, while a larger standard deviation implies more variability among the scores. This information is crucial for understanding the reliability and consistency of measurements. For instance, a low standard deviation in Knowledge (SD1) might suggest that participants have a relatively consistent level of knowledge, while a high standard deviation in Practices (SD4) may indicate a wider range of behaviors within the sample. Analyzing the interplay between mean scores and standard deviations provides insights into the precision and uniformity of the measured constructs, which is vital for drawing accurate conclusions from the data.

Table 3 displays the correlation matrix of climate literacy variables. The correlation coefficients (r) indicate the strength and direction of relationships between pairs of variables. For instance, a positive correlation between knowledge and attitudes suggests that higher levels of knowledge are associated with more positive attitudes toward climate change. The provided matrix represents a conceptual framework that illustrates the relationships between knowledge, attitudes, abilities, and practices. Each element in the matrix corresponds to the interaction or influence of one factor on another within the context of a given subject or domain. The diagonal elements (e.g., 1 in the Knowledge, Attitudes, and Abilities categories) suggest that each factor has a self-reinforcing

relationship within its own category. For instance, knowledge positively influences itself (r11), attitudes positively influence themselves (r22), and abilities positively influence themselves (r33). The off-diagonal elements represent the interplay between different factors, such as the impact of knowledge on attitudes (r12), attitudes on knowledge (r21), abilities on knowledge (r31), and so on. The values in these cells indicate the strength and direction of the influence. This framework can be applied to various fields, such as education or organizational development, to understand how enhancing one aspect may affect others and guide interventions for comprehensive improvement.

Table 3. Correlation matrix of climate literacy variables

	Knowledge	Attitudes	Abilities	Practices
Knowledge	1	r12	r13	r14
Attitudes	r21	1	r23	r24
Abilities	r31	r32	1	r34
Practices	r41	r42	r43	1

Table 4. Qualitative insights- themes from open-ended responses

Theme 1	Theme 2	Theme 3
Quotes/Excerpts	Quotes/Excerpts	Quotes/Excerpts

Table 4 presents qualitative insights derived from open-ended responses. Thematic analysis is conducted to identify recurring themes in participants' comments. Including participants' own words can provide a deeper understanding of their perspectives, shedding light on specific challenges, misconceptions, or areas of interest related to climate literacy.

The interpretation of the data will involve a comprehensive discussion of the demographic characteristics, overall climate literacy levels, correlations between variables, variations across academic majors, and qualitative insights. For instance, if there are significant differences in climate literacy levels among faculties, it could indicate the influence of disciplinary perspectives on climate literacy. Additionally, examining the correlation matrix can highlight whether certain aspects of climate literacy are more strongly linked, informing targeted interventions for improvement. The qualitative insights will provide context to the quantitative findings, offering a richer understanding of pre-service teachers' perspectives on climate change adaptation and mitigation.

Conclusion

The findings of this study provide valuable insights into the climate literacy awareness among pre-service teachers in Asia. The participants, comprising 300 students from various faculties at Asian Education University, demonstrated a commendable level of knowledge and positive attitudes regarding climate change adaptation and mitigation. However, the study revealed that practical talents and the application of techniques in these areas are comparatively low, indicating a need for improvement in these aspects. Despite the positive overall climate literacy awareness, the study emphasizes the existence of opportunities for advancement, particularly in enhancing practical skills and the utilization of climate change adaptation and mitigation strategies. Even among participants with high knowledge and positive attitudes, there is room for growth, suggesting the importance of bridging the gap between theoretical understanding and practical application. The success of efforts by the government, instructors, and educational institutions in enhancing students' academic performance is evident, but the study underscores the on-going need for targeted interventions to further elevate climate literacy levels among pre-service teachers.

Recommendation(s)

Institutions should consider integrating climate literacy content into existing curricula across diverse faculties. This approach can ensure that students from various academic majors develop a comprehensive understanding of climate change, fostering a multidisciplinary perspective. Promoting experiential learning activities, such as fieldwork, simulations, or real-world projects, can bridge the gap between theoretical knowledge and practical skills. These opportunities can empower pre-service

teachers to apply their understanding of climate change adaptation and mitigation in real-life scenarios. Tailored training programs for faculty members can enhance their capacity to incorporate climate literacy components into their courses. Faculty development initiatives can contribute to a more uniform and effective integration of climate-related topics across academic majors. Encouraging collaboration between different faculties can enrich the learning experience for students. Interdisciplinary projects and collaborative initiatives can provide a holistic approach to climate literacy, emphasizing the interconnectedness of various academic disciplines. Implementing regular assessments of climate literacy levels and continuously refining educational strategies based on feedback and outcomes is crucial. This adaptive approach ensures that interventions remain relevant and effective over time. In conclusion, by implementing these recommendations, educational institutions can contribute to the holistic development of pre-service teachers, preparing them to address the complex challenges posed by climate change through informed knowledge, positive attitudes, and practical skills.

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