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Assessing Environmental Literacy Knowledge of Early Childhood Education Teachers in District Mardan

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Abstract
One of the biggest problems in regard to sustainable development is environmental degradation, which is especially typical of developing countries such as Pakistan. Early Childhood Education (ECE) teachers are involved in influencing environmental awareness of children, yet there is little to be found about their own environmental literacy. The paper evaluated the level of environmental literacy of ECE teachers in District Mardan. A structured questionnaire was used to survey 100 teachers with semi-structured interviews with 12 teachers being used to complement the survey. Findings indicated that although teachers were generally aware of such issues as pollution and deforestation, their conceptual understanding of the topics of biodiversity, climate change and sustainable practices was low. Interviews revealed gaps in the curriculum, lack of training and use of personal experiences as opposed to structured knowledge. The research ends that environmental literacy should be reinforced in ECE level in Pakistan by undertaking professional development and curriculum reform.

Introduction
Perhaps one of the most burning issues of the 21 st century globally is environmental degradation, which poses a threat to ecosystems, human health, and sustainable development (UNESCO, 2021). The consequences of global warming, loss of biodiversity and pollution are far-reaching and particularly in countries in the Global South where vulnerabilities are increased by poor infrastructure and reliance on a limited resource base. The problem of deforestation, water shortage, overcrowding of cities, air pollution, and frequent climate-related calamities, e.g., floods and heatwaves are especially acute in Pakistan (Nielsen et al., 2020). These issues are not environmental alone, but rather social and economic because they have a direct impact on food security, livelihoods, and health of the people. These problems demand urgent policy measures as well as interventions in the form of education which creates sustainable attitudes among the citizens. Early Childhood Education (ECE) is one of such interventions which is strategically important. The early years are the time when children get their initial perceptions of the surrounding world. At this age, teachers play a central role in instilling in children their early knowledge of nature, environment and sustainability. It has been shown that young learners who experience positive environmental ideas are more apt to pro-

environmental attitudes and behaviors in adulthood (Rahman and Gul, 2021). In the Pakistani context, research done on teacher preparation and educational practices offers some valuable insights into the issues of institutionalising environmental literacy at the early childhood level. For example, research has shown problems of gender disparities and institutional barriers that affect access to professional development and pedagogical resources by teachers (Hijazi, Iqbal, & Shams, 2023). Broader looks at education system in Pakistan have highlighted the need for a more robust research culture, pedagogical innovation, and a blend of emerging pedagogies such as mobile learning to improve student outcomes (Iqbal & Shams, 2012, 2019). Moreover, the significance of teacher self-efficacy and the development of historical trends in early childhood education has been emphasized in scholarship, and the role of these variables in shaping teacher's ability to adopt and utilise new content areas including environmental education (Naz, Iqbal, & Shams, 2022). Together, these studies give a ground for the present study which specifically focuses on exploring the environmental literacy knowledge of ECE teachers in district Mardan thus filling one of the critical gaps related to understanding how local contextual factors affect sustainability education at the foundational stage. The question of how well teachers can promote such learning, however, is highly dependent on their environmental literacy. Without proper knowledge and confidence of the teacher about teaching environmental issues, children are likely to be given incomplete, simplified, or inconsistent information. This is especially worrying in Pakistan where formal curricula usually offer little or nothing about environmental concerns and where systematic teacher training in environmental matters is quite uncommon. Although the issue of environmental awareness is pressing in the country, there is lack of empirical studies on environmental literacy of ECE teachers, which results in a gap of knowledge in scholarly and policy spheres. It is on this background that, this study evaluated the related knowledge of District Mardan, Khyber Pakhtunkhwa ECE teachers on environmental literacy. Through investigation of the quantitative levels of knowledge and qualitative perceptions, the research was meant to produce a baseline evidence that is likely to inform teacher education, curriculum reform and the educational policy in general.

Literature Review

It has been established that the relationship between environmental literacy of teachers, and environmental attitude of students is strong and functional in various setups. Researchers around the world focus on the fact that more knowledgeable teachers regarding the environment are better able to implement the concept of sustainability into the classroom process, in addition to encouraging students to become environmentally responsible (Boeve-de Pauw et al., 2019). To illustrate, a study in Turkey and Malaysia discovered that the competence of the teacher in terms of environmental literacy has a positive impact on environmental awareness and problem-solving abilities of the students (Celik and Aydin, 2021). At the same time, research in Indonesia and China stresses that when the sustainability topics are introduced early in response to properly prepared teachers, children will become more environmentally sensitive (Lin and Li, 2020). On the other hand, the lack of teacher preparedness leads to broken, superficial, or wrong perceptions of environmental ideas by the learners (Iqbal, Shams, & Duha, 2019; McBride et al., 2019). Although global scholarship can be very informative, the case of Pakistan reflects a different scenario. The majority of studies have focused on teachers in high schools or institutions of higher learning and early childhood education remains unaddressed to a significant degree. The available literature shows that Pakistani educators tend to appreciate the significance of environmental education but tend to interpret it as a marginal and not central element of the teaching process (Rahman and Gul, 2021). As an example, Iqbal and Ahmad (2022) discovered that secondary-level teachers were not aware of environmental issues but only had some basic knowledge that could not be converted into classroom tasks. On the same note, Ahmed and Malik (2021) noted that teachers were motivated but their training possibilities in environmental education were insignificant thus leading to surface-level knowledge lacked systematic pedagogy.

Besides that, there are cultural and systemic reasons. The teaching fraternity most of the time uses textbooks as the primary source of information although textbooks often offer surface treatment on environmental issues. Environmental education is not commonly seen as a part of the curriculum, but rather a part of science or social studies which restrict the visibility and effectiveness of environmental education. Moreover, the qualitative research indicates that most educators perceive the environmental issues as the additional matter or co-curricular activity but not the necessary learning of young children (Rahman and Gul, 2021). The current research has three important extensions to the existing body of literature: Target ECE Teachers - As opposed to the previous studies that have been based on secondary and higher schools, this research has specifically studied teachers dealing with the early childhood learners as a very important but neglected cluster of students in the study of environmental education in Pakistan (Shams, Iqbal, Hijazi, & Naz, 2023). Mixed-Methods Approach - The mixed-methods approach involves the ability to engage in both the quantitative and qualitative evaluation of knowledge to create depth and breadth of knowledge through the use of an interview. Regional Context - With a particular area covered (District Mardan) where both environmental factors (e.g., floods, deforestation) and educational factors are at risk, the data can be used as context-related, and its potential implications to other areas in Pakistan.

Objectives

1. To assess the level of environmental literacy knowledge of ECE teachers in District Mardan.
2. To identify gaps in their understanding of environmental issues.
3. To explore teachers' perceptions of integrating environmental concepts in early childhood classrooms.

Methodology

A descriptive survey design was employed.

- Sample: 100 ECE teachers were selected from government and private schools in District Mardan through stratified random sampling.
- Data Collection Tools:
    - A structured questionnaire with 30 items measured teachers' knowledge of pollution, conservation, biodiversity, water management, and climate change.
    - Semi-structured interviews were conducted with 12 teachers to gain deeper insights into their perceptions and challenges.
- Data Analysis: Quantitative data were analyzed using descriptive statistics (means, frequencies, percentages). Qualitative data were thematically analyzed.

Results

Table 1: Environmental Knowledge of ECE Teachers in District Mardan (N = 100)

Environmental Issue	% with Correct Knowledge	% with Partial Knowledge	% with No Knowledge
Air & Water Pollution	85%	10%	5%
Deforestation	70%	20%	10%
Biodiversity	38%	30%	32%
Climate Change	42%	28%	30%
Water Conservation	60%	25%	15%

Interpretatio

Table 1 shows the distribution of levels of knowledge of ECE teachers in 5 major environmental issues. The data show a high percentage of teachers (85%) showed proper knowledge in relation to air and water pollution, reflecting the higher public exposure to these visual problems through media and community campaigns. Similarly, deforestation was well understood; 70% of teachers responded correctly, probably because of its relevance to the region's socio-economic context where forest resources are often discussed. By contrast, knowledge gaps are visible in more scientific or less visible areas. Only 38% of teachers had correct knowledge of biodiversity with almost a third of teachers (32%) having no knowledge of biodiversity. Likewise, climate change knowledge was relatively weak (less than half (42%) of teachers got the right answer), despite Pakistan's high vulnerability to climate-related disasters. Knowledge of water conservation was moderate (60%), which still left sufficient room for improvement. These results indicate that teachers are not lacking knowledge about problems which can be observed locally, such as pollution and deforestation, but they are weaker on complex or global level problems, such as biodiversity loss and climate change. This gap highlights the need for specific professional development programs in environmental literacy for ECE teachers.

Qualitative Findings

To complement the quantitative survey, semi-structured interviews were carried out with a subset of ECE teachers (n = 15). These interviews helped us to gain deeper insights about teachers' perceptions of environmental literacy and their professional problems. Four major themes emerged: Curriculum Gaps Teachers routinely reported that ECE textbooks have very little environmental content. Most of the environmental references in the curriculum are indirect (e.g. seasonal changes, plants or animals) with little explicit coverage of pressing issues such as pollution, climate change or biodiversity. As one teacher noted: "Our textbooks show pictures of trees and rivers, but they don't explain why it is bad for us to chop trees down or how climate is changing. We must make up examples for ourselves." This implies that the curriculum lacks adequate resources to equip teachers with structured knowledge in teaching topics effectively on the environment. Training Deficiency Almost all of the participants highlighted a shortage of professional training opportunities in environmental education. Most had attended general pedagogical workshops but not a single program focused on the environmental knowledge or strategies for teaching. Teachers expressed the lack of training in teaching complex environmental issues, leaving them underprepared to teach. "I have been teaching for eight years, but I never had training on the environment." If I get training, I can teach better and also guide children to practical activities." This finding suggests an in-service teacher development systemic gap. Reliance on Experience In the absence of curriculum and training support, teachers drew heavily on personal observations and experiences to teach environmental topics. For instance, burning of waste in neighbourhoods, floods in nearby rivers, and seasonal drought were common examples that teachers used in classrooms. Children see garbage burning outside of their houses. I use that to explain pollution, because that's something they already know." While this practice helped to put lessons into context, it meant that knowledge held by teachers was often anecdotal and insufficient in scientific depths.

Positive Attitudes but Limited Knowledge

Interestingly, teachers across both genders expressed a strong willingness and positive attitude toward teaching environmental concepts. They viewed it as an important responsibility for preparing children for the future. However, many admitted that they lacked the confidence and technical knowledge to explain concepts like the greenhouse effect or biodiversity loss in age-appropriate ways. "I want to teach children about climate change, but honestly, I don't fully understand it myself. I am afraid I

might give them the wrong information." This gap between attitude and knowledge highlights the potential for targeted interventions: while motivation exists, knowledge enhancement is urgently needed.

Discussion

Findings suggest that while ECE teachers in Mardan are aware of basic environmental issues, their conceptual depth remains limited. This aligns with previous studies in Pakistan (Ahmed and Malik, 2021; Iqbal and Ahmad, 2022) and reflects the broader challenge of insufficient environmental education in teacher training programs. The lack of systematic professional development was a major barrier. Similar patterns have been observed internationally, where teacher preparedness has been found to be a strong predictor of effective integration of sustainability concepts (Celik and Aydin, 2021). Interestingly, teachers' reliance on lived experiences indicates potential for context-based learning. If properly trained, they could draw from local environmental challenges, such as floods, deforestation, and waste management in Mardan, to make environmental education more relevant for children.

Conclusion

This study showed that ECE teachers in District Mardan have general awareness of environmental issues but they are not well aware about the in-depth knowledge, particularly on biodiversity and climate change. Teachers also reported on a lack of training and support with curriculum. To fill these gaps, teacher education programmes in Pakistan have to include environmental literacy as an integral component. Regular professional development workshops and updated ECE curricula can provide the knowledge and confidence of teachers to cultivate environmental awareness from early childhood.

Recommendations:

1. Organize specific workshops focusing on Environmental literacy for ECE teachers.
2. Curriculum Development: Include local content related to the environment in ECE textbooks.
3. Policy Support: Environmental education should be made compulsory in a pre-service teacher education module by the government. Community Linkages: Urge teachers to draw on local environmental issues as case studies for children's learning.

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