

Preservice Teachers' Experiences with Eco-Innovative Learning in Oman

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ABSTRACT

This study investigates the integration of sustainability principles into STEAM (Science, Technology, Engineering, Arts, Mathematics) education through the design and evaluation of eco-innovative learning modules for preservice teachers at Sultan Qaboos University, Sultanate of Oman. Addressing the limited integration of sustainability themes in teacher education, the project engaged preservice teachers ($n \approx 42$) enrolled in Educational Curriculum for Primary Science and Mathematics and Development of Scientific and Mathematical Concepts and Skills courses. Participants specialized in Primary Education and Early Childhood Education, providing a diverse foundation for exploring how sustainability can be embedded across disciplines. Qualitative data were collected through focus group interviews and reflective journals to capture participants' experiences, attitudes, and pedagogical reflections during an 8–10-week intervention featuring hands-on STEAM activities (e.g., solar-powered models, recycling-based engineering projects, and art-science sustainability exhibits). Thematic analysis revealed three major themes: (1) Transformative awareness, as participants developed a deeper understanding of environmental issues and their educational relevance; (2) Pedagogical innovation, demonstrating increased creativity, collaboration, and confidence in designing sustainability-infused STEAM lessons; and (3) Contextual challenges and opportunities, including curriculum constraints, resource limitations, and the potential of interdisciplinary, project-based learning. Findings inform the development of a contextually grounded framework for integrating sustainability within STEAM teacher education in Oman. The study advances eco-innovative pedagogical practices that prepare future teachers to promote sustainable thinking in primary classrooms, aligning with UN SDG 4 (Quality Education) and SDG 13 (Climate Action).

Keywords: teacher education; reflective practice; qualitative research; curriculum innovation; sustainable pedagogy