Integrating Informal Computational Thinking and Outdoor Learning in Elementary Teacher Education:
Scaffolding Plugged and Unplugged Exploration

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EXECUTIVE SUMMARY

Tech-focused K-12 reform promotes infusing computational thinking (CT), requiring teacher education programs to integrate CT into existing curricula. Several ways exist for integrating CT, but links to informal learning and outdoor education are lacking. Here, the authors position "unplugged" CT and outdoor education as entry points

for engaging in informal technology education by profiling a series of connected CT tasks for the elementary preservice teacher (PST) classroom. Participants consisted of 43 PSTs enrolled in an ed-tech course, who were surveyed before and after the tasks about their understanding of CT and related self-efficacy. Data sources included PST surveys, lesson reflections, and resulting classroom artifacts, analyzed independently by the researchers using open coding and descriptive statistics. Results revealed increases in CT, self-efficacy, and life science understandings following the intervention and provided concrete directions for further exploration and teacher education within informal spaces.

INTRODUCTION

Linking informal science learning opportunities to elementary classroom contexts is essential for sustaining rich learning experiences that connect students to their communities (Hoover, 2021). Using place-based informal science education, educators can integrate young learners' communities into the curriculum to create culturally sustaining environments (Bascopé & Reiss, 2021) and foster scientific literacy and environmental stewardship (Walan & Gericke, 2021). Science learning is frequently disconnected from students' lived experiences, particularly with environmental education, often presenting the dominant Western cultural view of environmental efforts (Makondo & Thomas, 2018). This contrasts with recognizing learners as having unique funds of knowledge (Cruz et al., 2018). As such, it is imperative to consider what and how we teach about science, as the topic being taught and how it is presented can influence students' science, technology, engineering, and math (STEM) interests (Walan & Gericke, 2021).

Young learners are naturally inquisitive, asking questions and seeking answers to what they experience in the world (Jordania, 2023). One of the best ways children learn is through informal learning experiences such as playing, gardening with family members, exploring their own backyards, and visiting local parks within their communities (Datta, 2016). Connected, engaging children with immersive nature experiences can support their social, mental, and physical well-being (Mygind et al., 2019). Many of these informal learning activities intersect directly with the outdoors and environmental education and can be implemented in tandem with matching formal experiences to support students' STEM interests and achievement (Burghardt & Hecht, 2020).

Perhaps incongruent at the surface level with nature-based experiences, computational thinking, or "CT"-based activities like coding, game design, and robotics also offer powerful contexts for providing informal STEM learning opportunities to children (Newton et al., 2020). CT can be simply defined as the way of thinking