Summer Camps as Introductory STEM Teaching Experiences for Preservice Teachers

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Recent editorials in *Innovations* have contemplated several questions regarding teacher preparation, particularly in the face of a national science teacher shortage, concerns regarding teacher autonomy, and near-ubiquitous violence in schools. Science education is at an inflection point, and innovative approaches to preparing science teachers are necessary to create a thriving and diverse generation of STEM educators. In this editorial, we propose one such innovation—integrated STEM summer camps as an introductory field experience for preservice STEM teachers. To contextualize this work, we are STEM educators at Illinois State University's Center for Mathematics, Science, and Technology who are currently directing 10 weeks of STEM camps offered through partnerships with local schools and community organizations. Below, we identify the benefits of summer camps as a field experience for PSTs and describe related features of our summer-camp programming, demonstrating the potential of summer camps to promote retention in STEM teacher education programs and confidence in teaching STEM. However, to quote LeVar Burton, the host of *Reading Rainbow*, "You don't have to take [our] word for it." Throughout this piece, quotes from PSTs who have participated in our summer-camp teaching experience illuminate how this experience has impacted them.

Field experiences with K–12 students are a critical component of all teacher education programs because they provide teacher candidates with opportunities to apply theories regarding learning and child development and teach content in authentic settings (Darling-Hammond, 2014; Hunter & Botchwey, 2017). However, formal classrooms are not the only potential setting for such field experiences, as work in *Innovations* regularly describes (e.g., Boesdorfer, 2019; Hermann & Honeychuck, 2023; Porter & Lardy, 2020). Indeed, scholars have repeatedly called for teaching experiences in informal settings such as museums, summer camps, and science outreach programs to be incorporated into teacher education programs (e.g., Cooke-Nieves et al., 2022; Ferry, 1995; Hsu, 2016; Jung & Tonso, 2006). Summer STEM camps provide a unique opportunity for preservice teachers (PSTs), whom we refer to as "mentors" in our programming, to experience teaching integrated STEM early in their educational careers in a flexible and informal setting. Compared to clinical experiences in formal classroom settings, camps offer greater flexibility in content and teaching practices, increased autonomy earlier in the field experience, and a lower-stakes environment in which mentors can develop their teaching identities.

> Being a mentor this year has confirmed my decision to become a middle school math teacher. STEM is an important part of our everyday life and is constantly changing. Having a lead role in lesson planning and leading classroom STEM activities has been a valuable experience.
>
> – *Augustine*

Summer-camp teaching experiences have demonstrated increases in PSTs' teaching self-efficacy and confidence (Franks et al., 2016; Hsu, 2016; Seung et al., 2019), which can be attributed, at least in part, to the lowered pressure to address specific curricular goals and prepare for high-stakes tests that directly impact students' and teachers' futures (Seung et al., 2019). The activities in our summer camps vary greatly between camps. Several camps focus on integrated STEM concepts and include engineering and making challenges, whereas other camps focus solely on mathematics or science. For example, one camp engages 60 rising fourth- and fifth-grade campers in designing and building a pollinator garden at their community center.

> I believe the less formal setting of a summer STEM camp is an excellent "foot in the door" opportunity before heading into a more formal, school setting. It allows me to focus on two important aspects of teaching STEM: Student engagement in STEM and simplifying complicated concepts. Building relationships, classroom management, and effective evaluations are practiced but not to the scale of a full semester or year of instruction with the same group of students. This experience has given me greater confidence in myself that I can get students engaged in learning STEM and that I can explain the concepts to much younger students than I believed I could.
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> – *James*

Furthermore, the timing and flexibility of summer camps allow PSTs to receive consistent mentorship and feedback from camp leaders throughout the experience (Seung et al., 2019), promoting increased self-reflection (Whitaker & Valtierra, 2018). Although this mentorship, feedback, and reflection is not unique to summer camps, we have observed that the structure of our summer camps, which are typically half-days, are particularly conducive to holding daily group debriefings, including feedback from camp leaders and reflections from the mentors. We facilitate these reflection discussions through three questions that each mentor answers: (1) What was challenging today, (2) what went well today, (3) and what are you proud of yourself for today? Although initially difficult for mentors to answer, these questions provide an opportunity to reflect on the day's activities, suggest improvements for the next time the activity is implemented, receive feedback from peers on challenges, and perhaps most importantly, guide mentors to recognize their accomplishments and growth as educators. Through these daily debriefings, mentors leave each day with concrete and actionable feedback that can be implemented the following day.

> The experience of being a STEM mentor whose educational path is not necessarily associated with STEM greatly inspired my career path. [Authors' note: Inés is pursuing a graduate degree in school psychology.] I was able to gain knowledge from and alongside my campers. I found the most rewarding part was the one-on-one interactions with campers that showed me what I would excel in with regards to future experiences. Being a STEM mentor gave me the space to explore what my strengths and weaknesses were when working with various age groups and topics.
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> – *Inés*

We would be remiss to avoid discussing the current demographics of teachers in the United States, which was addressed in another recent editorial (Darner & Boesdorfer, 2022)—80% of teachers in the United States are White, and 77% are women (Irwin et al., 2023). This drastically differs from the demographics of public-school students, only 46% of whom are White, with Black and Hispanic students comprising 28% and 15% of students, respectively (Irwin et al., 2023). Summer-camp teaching experiences also provide valuable opportunities for PSTs to engage with students whose backgrounds differ from their own (Franks et al., 2016), which may increase PSTs' self-confidence and self-efficacy in teaching students from a variety of backgrounds (Whitaker & Valtierra, 2018). Many of our partnerships are with community organizations that serve primarily Black and Latine communities, whereas a majority of our mentors are White. Without going into extensive detail that would be more appropriate for a full article, we spent several days during our 2-week training session at the beginning of the summer preparing mentors to create identity-safe learning spaces for all campers.

There are many additional benefits of summer STEM camps as an introductory teaching experience for PSTs that we have not yet discussed, such as identifying the many overlaps between STEM disciplinary practices and the experience of designing, implementing, revising, and reimplementing integrated STEM lessons. Below, we share a reflection from Betty, who served as a mentor for three consecutive summers and will begin her first year as a first-grade teacher in the fall.

> I have come to realize that being a camp mentor for the past 3 years has greatly impacted my way of teaching STEM concepts. STEM concepts are known for generally being pushed aside in the K–12 setting and, from what I've observed, also in teacher preparation programs. Having said that, working as a camp mentor, I have learned not only how to create lessons that follow the 5E model and engineering design process but also how to effectively facilitate lessons in a way that makes all students excited to be working with STEM concepts. As a mentor having worked through various camps, I have had the opportunity to learn from STEM professionals who created a space that allowed me to practice and reflect on my teaching of STEM concepts. Because I've worked as a camp mentor, I now feel confident when it comes to teaching STEM concepts in my own classroom this year as a first-year teacher.
>
> *-Betty*

We hope that we have put forth a compelling argument for the inclusion of informal educational settings, particularly summer camps, in STEM teacher preparation programs. In light of the questions and uncertainty currently surrounding teacher preparation, retention, and persistence, we strive to continue to develop novel programs to engage PSTS in valuable teaching experiences early in their college careers. Based on our experiences, serving as a mentor in summer STEM camps can be truly transformational for future STEM teachers, and such transformational experiences will prove to be critical to the continued progress of STEM education in our society.

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