

Teacher Librarians Supporting STEM Education

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Introduction and Research Problem

STEM education is an approach to teaching and learning that integrates the content and skills of science, technology, engineering, and mathematics; which promotes critical thinking, higher-order thinking, and problem solving (NSTA, 2020). Students engage in STEM learning in many different ways, with technology playing an important role. Students need exposure to current and emerging technologies appropriate for STEM learning, but also instruction on how to interact with and utilize digital tools to solve problems and improve learning (Subramaniam & Edwards, 2014; Subramaniam et al., 2013).

Teacher librarians can engage students and support teachers by providing access to digital resources, encouraging students in authentic inquiry practices, and providing real-world collaborative learning opportunities to promote STEM learning. Yet, it has been found that teacher librarians in the U.S. felt they were not prepared with the necessary knowledge, skills, and abilities to provide this support (Anonymous, 2018). A federally funded project addressed this need by providing professional development (PD) for teacher librarians on how they can support STEM education efforts in their schools. This research was conducted with the purpose of identifying the influence of this PD on improving teacher librarians' knowledge, skills, and abilities to support STEM education efforts in their schools.

Literature Review

Technology and digital resources have become an integral part of education in the past decade and with the COVID-19 pandemic, the importance of effectively integrating and utilizing digital tools to provide and enrich student learning became paramount (Sailer et al., 2021; Seufert et al., 2021; Xie et al., 2021). But it also reinforced that teachers continue to struggle

with using digital resources effectively (e.g., Graves & Bowers, 2018; Mao et al., 2019; UNESCO, 2020; Xie et al., 2021). This positions teacher librarians, as information specialists, to collaborate with teachers across multiple disciplines and embrace leadership roles through integrating digital tools for learning, especially in the STEM areas where digital tools can enhance student learning by enabling them to comprehend, visualize, and explain difficult concepts by providing authentic learning and analytical experiences (Anonymous, 2018; Mardis, 2014; Subramaniam et al., 2013).

The research that has examined the role that teacher librarians can play in supporting the STEM areas and STEM education finds that teacher librarians can play an important role in supporting students and teachers (e.g., Anonymous, 2018; Rawson et al., 2015; Subramaniam et al., 2013). Teacher librarians can connect students with digital resources and provide instruction for students on how to utilize a variety of digital resources to support their own learning. Teacher librarians can also lead in this area through locating and curating digital resources to support STEM content areas for teachers to utilize in their instruction, providing training on how to effectively use technology and digital tools to enhance their instruction, and model in their own teaching (e.g., Anonymous, 2012; Mardis, 2014; Subramaniam et al., 2013; Wine, 2016; Yi et al., 2019). Yet, despite these opportunities for teacher librarians to become actively involved in STEM education, research suggests that teacher librarians are not embracing them (Anonymous, 2018; Mardis, 2007; Rawson et al., 2015; Schultz-Jones, 2010; Subramaniam et al., 2012; Subramaniam et al., 2013).

Methodology

In the summers of 2018 (YEAR 1) and 2019 (YEAR 2), a federally funded project provided professional development (PD) for a total of 78 school librarians working in rural areas on supporting STEM education, with a focus on utilizing digital tools and making community connections. School librarian participants were recruited from targeted rural areas from eight states in the US.

Participants

In YEAR 1 there were 176 applicants and after a rigorous application process, 40 participants were selected based on the rural designation of the county/district where they work and their statement of purpose. Two participants withdrew at the last minute leaving 38. In YEAR 2 there were 173 applicants, 40 applicants were selected and attended.

Professional Development Design

The PD was structured as a four-day face-to-face workshop in the summer, with a semester long online course throughout the following fall semester. Participants were also enrolled in the private project Facebook group that served as a community of practice support group. The established TPACK framework (Koehler & Mishra, 2009) and the results from the needs assessment research were utilized to develop the professional development (Anonymous, 2018). The TPACK framework includes: pedagogical content knowledge - the ability to teach content to others; technological pedagogical knowledge - how to use technologies as methods for instruction, and technological pedagogical content knowledge - the combination technology to teach different subject matters. The knowledge types are not independent of each other and serve as a framework for using technology as part of the instructional process (Koehler & Mishra, 2009).

Research Design & Data Analysis

This study utilized a pre/post-test quasi-experimental design to determine the influence of the PD on teacher librarians' knowledge, skills, and abilities to support STEM education (Creswell, 2013). The survey was based on the established measure *Survey of Preservice Teachers' Knowledge of Teaching and Technology* (Schmid et al., 2009), which is a Likert scale survey that includes 10 subscale measures for each TPACK domain, including 4 subscales for different areas of content knowledge. This survey was then adapted and pilot tested by the grant evaluator.

The quantitative data was analyzed using a paired t-test to evaluate the impact of the PD. ANOVA was run between the pre and post-test for each year. Detailed statistical results will be presented in the full paper.

Findings & Implications

The participants were a mix of elementary (42.5%) and secondary school librarians (22.5%), while 35% serve multiple schools. The years of experience varied from one to 20 years with an average of seven years in the profession, and 100% of participants were female. In terms of previous PD in the STEM areas 40% of participants had no PD in this area, while others mentioned attending sessions at conferences related to STEM.

The pre-test data confirms previous research, that there is a significant gap in the knowledge, skills, and abilities of school librarians when it comes to supporting STEM education efforts in their schools. Additionally, school librarians aren't being offered many professional growth opportunities to further their knowledge in this area. Post-test data provides information on the influence that the PD had on the participants' knowledge, skills, and perceived abilities in supporting STEM education. Implications for practicing teacher librarians and teacher librarian scholarship will be presented in the full paper.

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Biography

Melissa P. Johnston is a Professor at the University of West Georgia, where she teaches graduate courses in the school library media program. Johnston's research and publications focus on the school librarian's leadership role in integrating technology. She is the PI for the [REALISD Project](#), an IMLS funded grant, to provide professional development for rural school librarians to support STEM education efforts in their schools.