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Factors Impacting Science and Mathematics Teachers' Competencies in TPACK in STEM Context

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Abstract : STEM teachers face the challenge of possessing expertise not only in their subject disciplines but also in the pedagogical knowledge required for integrated STEM lessons. However, research reveals a lack of pedagogical competencies related to project-based learning (PBL) in the STEM context. To bridge this gap, the study examines teachers' competencies and self-efficacy in TPACK (Technological Pedagogical Content Knowledge) and its specific integration with PBL and STEM content. Data from 245 specialized science and math teachers were collected using a questionnaire. The study emphasizes the importance of addressing gender disparities, supporting formal teacher education, and recognizing the expertise and experiences of STEM teachers in effective technology integration. The findings indicate that gender plays a role in self-efficacy beliefs, with females exhibiting higher confidence in pedagogical knowledge and males demonstrating higher confidence in technological knowledge. Teaching experience and workload factors have a limited impact on teachers' Technological Pedagogical Content Knowledge (TPACK). These findings enhance our understanding of contextual factors impacting science and math teachers' self-efficacy in utilizing TPACK for STEM and PBL. They inform the development of targeted interventions, professional development programs, and support systems to enhance teachers' competencies and self-efficacy in TPACK for teaching science and Mathematics through STEM and PBL.

Keywords : technological pedagogical content knowledge, TPACK, STEM, project-based learning, PBL, self-efficacy, mathematics, science
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