

Scholarship of Teaching and Learning: Promoting Preservice Elementary Mathematics Teachers' Success through Undergraduate STEM Research

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STEM Course: MATH 3381 Elementary Mathematics Foundations III Sections 3 and 5 (expected enrollment: 40 students)

Executive Summary

There are several High Impact Practices (HIPs) which have proven effective in increasing success among undergraduate students. Undergraduate research, in particular, has been shown to effectively engage students in their discipline, increases content knowledge, and develop marketable skills necessary for future employment. Extensive research has demonstrated that incorporating these practices as part of the undergraduate educational experience not only has a positive effect on student learning and retention but can also be life changing for a student (Kuh, 2008). Furthermore, HIPs have been demonstrated to be particularly powerful as a teaching strategy for low-income, first-generation students. HIPs not only increase learning outcomes but have been positively associated with persistence and GPA, increases in critical thinking and writing skills, higher student engagement, and greater appreciation for diversity. This project will allow students enrolled in MATH 3381 to engage in an authentic STEM research project in which they explore digital math games and rank them in several key areas as part of a pilot study. In addition to collecting data, they will be able to present their findings at SHSU's Undergraduate Research Symposium and at the Southwest Educational Research Association (SERA) annual conference. This authentic research experience will allow these preservice teachers to grow in their confidence and in understanding what mathematics education research entails and how it applies to their future students.

Project Narrative

Rationale

Elementary preservice mathematics teachers encounter several unique challenges which can hinder their ability to effectively teach mathematics. First, elementary preservice teacher mathematics anxiety is well documented (Gresham, 2018) along with its effects on their future students' math achievement (Ramirez et al., 2018). In addition, research has shown that preservice elementary and middle grades teachers often have poor mathematical ability and confidence (Bischoff et al., 1999; Er, 2018) which also increases student anxiety and contributes to lower course completion rates. In addition, elementary and middle grades mathematics pre-service teachers need authentic experiences with technology to overcome preconceived misunderstandings about the effective use of technology to teach mathematics (Karatas et al., 2017). However, authentic undergraduate research opportunities have been found to be one of the most effective high-impact practices for increasing rates of student retention, student engagement, and student learning (Kuh, 2008). Therefore, the purpose of this proposed project to engage preservice elementary teachers enrolled in MATH 3381 in an authentic STEM research project in which they explore digital math games and rank them in several key areas as part of a pilot study. In addition to collecting data, they will be able to present their findings at SHSU's Undergraduate Research Symposium and at the Southwest Educational Research Association (SERA) annual conference. This authentic research experience will allow these preservice teachers to grow in their confidence and in understanding what mathematics education research entails and how it applies to their future students.

Materials and Methods

Undergraduate researchers will collect data on 100-150 commercially available digital math games for both touch-screen tablet and laptop platforms. While playing these games, the undergraduate researchers will rank the games using a protocol based on a conceptual framework adapted from All, Castellar, and Looy's (2016) work on assessing the effectiveness of digital game-based learning as part of the *Impact of Design Features in Digital Math Games on Children's Mathematics Learning Pilot Study*. As part of this,

undergraduate researchers will be trained in assessing learning, motivational, and efficiency outcomes, as well as mathematics content specific criteria for effective digital mathematics games. Each game will be double coded to ensure inter-rater reliability. In addition, they will be trained in appropriate ethical data collection procedures and will present their findings as part of SHSU's Undergraduate Research Symposium and at the Southwest Educational Research Association (SERA) annual conference.

Expected Results and Dissemination Plan

By the end of Spring 2020, undergraduate researchers will have collectively played between 100-150 commercially available digital math games and will have ranked them according to the coding protocol. They will have also created a poster to present their findings at SHSU's undergraduate research symposium in April 2020 and a proposal to submit to the SERA conference for presentation in Spring 2021.

References

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