

# **Promoting STEM education in higher education through an interdisciplinary approach for early childhood education students**

## **Introduction**

To prepare our preservice PreK-3 teachers better academically for career and life, there has been a movement and push towards integrating STEM education in Middle Tennessee State University. Integration of STEM concepts into the curriculum is intended to encourage critical thinking, problem solving, and collaboration as our students face an increasingly diverse and complex world. The Tennessee Department of Education, under the direction of the STEM Leadership Council, rolled out STEM standards for K-12 education beginning with the 2018-2019 school year. Recommendations included creating new modules that integrate the STEM standards, as well as providing both classroom and externally based hands-on learning opportunities for K-12 students (TN Department of Education, 2018). With this change at the elementary and secondary levels, it was thus imperative that higher education also integrate STEM standards into the curriculum.

One obstacle, however, is that studies have shown that most teacher preparation programs do not have a strong focus on STEM education (Schmidt & Fulton, 2017; DiFrancesca & McIntyre, 2014; Teo & Ke, 2014). Sondergeld, Johnson & Walten (2016) suggested that for impactful and sustainable K-12 STEM education, a partnership model should be adopted. Using this model, we intentionally redesigned a course syllabus to integrate STEM education through a partnership with the MTSU library's Makerspace, as well as a community partnership with our local Boys & Girls Clubs. STEM education lends itself well to using an interdisciplinary approach in combining different disciplines and providing service to community partners.

## **Research questions**

Specifically, three research questions were targeted in this study

1. What is preservice teachers' perception regarding the use of makerspace at MTSU Walker Library?
2. What is preservice teachers' perception regarding the use of an interdisciplinary approach in STEM education?
3. What is preservice teachers' perception of bridging theory into practice?

## **Methodology and Timeline**

An eight questions pre and post questionnaire were administered on 20 students using Qualtrics. The timeline for this STEM integration started with planning and course redesign in summer 2019, and implementation in the fall 2019 semester. Data were analyzed in Spring 2020.

### Summer 2019 (Course redesign and seeking partnerships)

The course redesign was ECE 4370: Effective Instruction. This class is an in-depth study equipping early childhood educators with experience in planning, implementing, and evaluating the programs and curriculum used with young children in their natural educational environments. The foundations for this course are developmentally appropriate practices in children's settings that are inclusive and diverse. The final project of the course involves applying the knowledge acquired during the semester to planning and delivering a classroom lesson for K-3 children in a local elementary school.

As part of the course redesign, several STEM-centered enhancements were made. It was decided that an essential component of the lesson delivery would be a student-created manipulative or teaching tool produced in the library's Makerspace. Walker Library's Education Librarian was asked to help students get ideas for this task by demonstrating various teaching manipulatives found in the library's specialized Curriculum library, as well as showing students various lesson planning resources. Creation of the teaching tool and deployment of the lesson would be the culmination of students' newly-honed library skills. Working in partnership with the library's Education Librarian, dates were set in fall 2019 to ensure that students could be trained in time to use the equipment prior to production of the teaching tool.

At the same time, the instructor for ECE 4370 wanted to ensure that students can bridge what they have learnt in theory to practice. A collaborative partnership with the local Boys & Girls Clubs was sought as the field experience. The Boys & Girls Clubs of Rutherford County (TN) was chosen due to their close proximity to the MTSU campus. This location would ensure that the preservice teachers could work with the Club's children and then get back to their classes on campus on time.

### Fall 2019 (Implementation)

During the fall 2019 semester, preservice teachers gained knowledge in planning, implementing and evaluating curriculum using an interdisciplinary approach integrating STEM education. They signed up for training at the library's Makerspace, and later worked in pairs to build prototypes for their lessons on STEM standards. They visited the Boys & Girls Clubs of Rutherford County to implement their planned lessons. The culmination of the course was to invite the children from the Boys & Girls Clubs to visit the library's Makerspace and witness the creation of the prototypes used in the small group lessons.

### **Data Analysis & Results**

Using SPSS, results were coded using T test for significance and themes. This whole experience taught the preservice teachers many valuable skills such as the new knowledge gained from the use of Makerspace, using an interdisciplinary approach in integrating their knowledge and bridging theory into practice.

### **Conclusion**

To ensure that our nation is equipped with the skills and knowledge of the high demand STEM-related careers, it is imperative that higher education take the lead in preparing preservice teachers. University educators need to show explicit connections in our syllabi to integrate STEM education into the curriculum; additionally, we need to seek opportunities for partnerships with community members and across disciplines. In this way, we are modeling for the preservice teachers what they can achieve when they are in their future diverse classrooms of K-12 students.

## References

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