Shifting teachers' attitudes toward development STEM skills in early childhood

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Science, technology, engineering, and mathematics (STEM) education is regarded internationally as critical to effectively preparing citizens for the twenty-first century (Early Childhood STEM Working Group, 2017; McClure et al., 2017, National Research Council, 2011). One basic assumption underlying this work is that a critical step to improve outcomes for children is to improve support for their teachers so that educators are empowered to provide high-quality STEM experiences during the first years of primary school. This paper presents the case study that emerged from the Kanga-Kids Professional Development Model of Training for in-service Math teachers in the early years of elementary school. The model includes three main components: (1) workshops, (2) reflective coaching cycles, and (3) professional learning communities /workgroups.

Professional development should include methods for modeling and fostering creativity in the classroom. Many educators struggle to understand that creativity development is fostered through a process of exploration, play, risk-taking, making mistakes, self-evaluation, and feedback (Runco, 2014; Sternberg & Williams, 1996). All these principles were successfully implemented in the Kanga-Kids in-service teachers training course.

The program provided high-quality STEM professional support while simultaneously being practical to implement, enjoyable, and useful to educators and their practice. This paper was written to exemplify how a professional development model that is research-based, collaborative, and realistic when put into practice in settings serving diverse learners can be designed. As can be seen from the findings, the program unveiled creative ways to teach math using puzzles. Teacher professional development focusing on high-quality math education can support educators in creating effective childhood education programs for all children. The participants and instructor were extremely satisfied with the resulting model and reported that all three main components (workshops, reflective coaching cycles and feedback, and professional learning communities/workgroups) were enjoyable and beneficial for their practice.

The educators evaluated the implementation of the Kanga-Kids program as positive for creating a community of inquiry where children and educators study and research together, with space for children's self-directed and discussion-based explorations. Adults can take on varied roles, including director, helper, or partner to children's learning. Educators' confidence in teaching STEM increased, and participants reflected on their opinions and attitudes and implemented their newfound knowledge in class. Through Kanga-Kids, they were able to overcome doubts and have realized that STEM can be simple and is present in everyday activities.

In conclusion, it appears that participation in Kanga-Kids has offered a variety of benefits to participants, and subsequently, the children benefit as well. Five (out of the six) elements of effective STEM education as outlined by Murphy et al. (2018) were evident among the corpus of qualitative data from the evaluation study: capabilities (creativity, problem-solving, design thinking), dispositions (the effect of a pleasant teaching/learning atmosphere and pedagogical choices), educational practices (in terms of problem-solving and higher-order thinking skills), equity (in terms of novices and

experienced teachers), educator capacities (the instructor exhibited the ability to deliver inquiry-based STEM meetings).

Our study also provides evidence that STEM education should be implemented during early childhood since the majority of the in-service teachers in the present study stated that STEM education is suitable for early childhood education. Following up on their own experience as learners and then as teachers, all in-service teachers also expressed their commitment to developing STEM skills in early childhood education.

We believe that the present study contributes to the current literature related to STEM education in early childhood, particularly in its presentation of a good example of professional development for in-service early childhood teachers in the context of integrated STEM education. Finally, the results obtained from the current study may be beneficial in providing implications for early childhood education program developers, as well as their offering an example of STEM instruction content and processes for early childhood educators and researchers.

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