Integrating STEM Opportunities for Young Learners

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Science, Technology, Engineering, and Mathematics (STEM) education efforts to prepare K-12 students for college and future careers are evolving and remain an important factor in the growth and development of economies across the world (Carter et al. 2014; Ge et al. 2015; Howard 2016; Legewie and DiPrete 2011). In the US alone, the demand for workers is projected to double resulting in 19 million more jobs than workers to fill positions by 2028 (Humes et al. 2011). An increase in the number of jobs available across the world may suggest a greater need for students to select STEM courses and careers. Efforts to increase students' positive perspectives and pursuits of STEM careers are necessary to meet the growing demand for STEM workers (National Science Foundation, 2011). STEM education meets the present need and facilitates economic progress by preparing students to innovate and succeed in a technological business world (Altiner 2018). Additionally, STEM literacy is the knowledge and understanding of mathematical and scientific processes critical to living a productive and engaged life (National Research Council 2011, 2012).

Years of research in the area of STEM focused on upper grade students and university students, yet recent calls for higher importance to be given to STEM in early school years has resulted in an increase of scholarship (Johnson 2012; Sikma and Osborne 2014). Unfortunately, priorities placed on the teaching foundational skills (e.g., basics of math, reading, spelling) and the need to teach required instructional minutes have negatively impacted the level of innovation in classrooms during the early years of schooling. To respond to the call to action districts containing schools for young learners (e.g., elementary schools) are establishing in-school opportunities that infuse STEM concepts throughout entire curricula, yet not without obstacles. STEM opportunities for young learners can potentially tap into the curiosity and inquisitiveness of students in younger grades, hence creating a

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higher level of STEM competence (Isabelle and Valle 2016). Accordingly, research in this area concentrates on the integration of elements of STEM concepts into different academic subjects given the priorities placed on teaching in the classrooms of young learners. The need for more research related to STEM learning opportunities during the more formative years of learning to better understand how to ensure high-quality instruction within environments persists (Howard 2016).

The articles in this special issue stem from an interdisciplinary group of researchers, envisioning to facilitate scholarly research and theory focused on contemporary issues related to technology, instruction, cognition, and learning. Both, technological as well as pedagogical issues and manifold implications for integrating STEM opportunities for young learners will be presented.

1 Paper Selection Process

This special issue is assembled from the extended versions of best papers from the Special Interest Group *Technology, Instruction Cognition and Learning* (TICL; <http://bit.ly/AERA-TICL>) presented at the *American Educational Research Association* (AERA; www.aera.net) 2017 Annual Meeting that was held in San Antonio, TX, USA in April 2017. Each contribution represents a unique research or technological approach that highlights the intersection of technology, instruction, cognition and learning.

During the AERA 2017 Annual Meeting, the editorial committee evaluated the paper presentations. Based on this evaluation and the previous results of the AERA double-blind review process, the highest ranked papers were selected for inclusion in this special issue. Authors of the selected papers were invited to extend their manuscripts for a full journal article by providing them detailed information about the journal's requirements. Authors submitted their full manuscripts by the end of January 2018. Each manuscript was assigned to at least three expert reviewers. Based on the comments of the reviewers and on the individual feedback of the editor, authors were asked to submit their final revised manuscript by the end of March 2018. The final acceptance of the four remaining manuscripts was completed by the beginning of April 2018.

2 Contributors to this Special Issue

This special issue begins with *Media and Technology in Preschool Classrooms: Manifesting Prosocial Behaviours When Using iPads*. The author, Rachel Ralph (University of British Columbia and Centre for Digital Media), employed a mixed methods approach with design-based research and video ethnography to investigate the prosocial behaviours of sharing among preschool-aged children when interacting with iPads.

Learning Math With Curious George and the Odd Squad: Transmedia in the Classroom by Elizabeth McCarthy (WestEd), Michelle Tiu (WestEd), and Linlin Li (WestEd) aimed to identify the affordances of transmedia-based learning in preschool and first grade classrooms during early mathematics learning through assessments of mathematics ability, classroom observations, and interviews with teachers.

Julie Hagge (Ohio State University) examined in *Coding to Create: A Subtext of Decisions as Early Adolescents Design Digital Media*, the ways in which youth engage in

digital composition with a focus on the decisions enacted by young learners when creating digital media through an online programming community.

The special issue concludes with *Computer Programming Effects in Elementary Classrooms: Perceptions and Career Aspirations in STEM* by Yune Tran (George Fox University). The author examined the potential impacts of computer science programming in elementary classrooms and whether these opportunities engender positive perceptions, foster confidence, and promote perseverance to nurture the future STEM career aspirations of young learners, particularly STEM and computer science careers. The findings point to positive benefits for early exposure to STEM and computer science for elementary-aged students.

The four papers of this special issue demonstrate the many complex interactions between technology, instruction, cognition, and learning and the importance of STEM opportunities for young learners. The distinguished group of researchers of the AERA Special Interest Group *Technology, Instruction Cognition and Learning* propose implications for the transformative potential of designing STEM learning environments in order to move forward toward preparing young learners for future education and STEM-related careers.

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