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Routes to STEM: Nurturing Science, Technology, Engineering and Mathematics in Early Years Education

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Currently, my research programme includes the 'Science Outside the Classroom' (SOtC) project[1] and I am thoroughly enjoying the whole experience! SOtC[1] is an exciting collaboration between university, kindergarten and primary school partners in the United Kingdom, Croatia, Spain and Sweden which develops, investigates and evaluates inclusive and innovative ways for young children to build scientific enquiry skills outdoors (Science Outside the Classroom, 2018). SOtC[1] educators are working together to find new ways to offer children opportunities to develop key science competencies such as problem-solving, communicating, reasoning, estimating, testing, observing, measuring, comparing, grouping, classifying, evaluating, asking and answering questions, while building non-cognitive skills including resilience, perseverance and confidence in outdoor contexts that promote their agency, physical activity and well-being.

In a global context where education is recognised as '…a basic human right and the foundation on which to build peace and drive sustainable development' (United Nations Educational Social and Cultural Organisation (UNESCO), 2017a, 4), SOtC[1] may be regarded as important work. We live in times 'characterised by a new explosion of scientific knowledge' and Science, Technology, Engineering and Mathematics (STEM) education is considered an important factor for strong economic and social futures (Organisation for Education Co-operation and Development (OECD), 2018, 3; United Nations Educational Social and Cultural Organisation (UNESCO), 2017b). STEM learning can promote important possibilities for building knowledge across disciplines and incorporates, for example, Arts (STEAM) and Environmental Education (E-STEM) (North American Association for Environmental Education (NAAEE), 2016; 2019; Pitt, 2009; Sochacka, Guyotte, and Walthera, 2016).

However, there is recognition that many countries - including those with advanced economies - are not educating appropriately to develop a strong STEM workforce for the future (Moser, Aparecido de Oliveira, and Bueno, 2017; National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, 2007). Equally, STEM advances are creating new social and economic inequalities (Li and Ranieri, 2013; Nieminen, 2016; OECD, 2018). For example, girls, women, and those who are less affluent often have poorer access than others to STEM education and careers (Han, 2016; UNESCO, 2017a).Therefore, given that children's early experiences are highly influential for their lifetime outcomes (Rebello Britto, Engle and Super, 2013), opportunities that children have in their earliest years to feel included and empowered in STEM learning may be highly salient for economic, socio-emotional, health and environmental well-being, not only for them as individuals, but for everyone (OECD, 2018). This issue features seven articles that reflect the view that STEM may have great value as a feature of early years education.

The issue opens with an article by Christine Jack and Steve Higgins, who ask: 'What is educational technology and how is it being used to support teaching and learning in the early years?' Their article reports on a qualitative study conducted in England for which semi-structured interviews were used to investigate early years practitioners' definitions of educational technologies, the educational technologies that were available in their settings and how they were used, and how their uses aligned with the practitioners' pedagogical beliefs. The second article in this issue is concerned with science education in early childhood: Sofie Areljung also used interviews to ask practitioners in Sweden 'Why do teachers adopt or resist a pedagogical idea for teaching science in preschool?' In another article from Sweden about science education, Robin Samuelsson focuses on 'Multimodal interaction for science learning in preschool: conceptual development with external tools across a science project'. This third article in the issue reports on ways a science project was tracked to reveal

teachers' and children's oral and physical interactions that supported the children's development of conceptual knowledge. The next article in this issue is from Argentina; Melina Furman, Mariana Luzuriaga, Inés Taylor, Diana Jarvis, Enzo Dominguez Prost and María Eugenia Podestá report on a study that investigated 'The use of questions in early years science'. By using observations and interviews, the researchers identified differences in the types of questions teachers asked of children aged 4-5 years who were learning about science in two settings that were socio-economically diverse.

In their article 'Developing elementary school children's water conversation action competence: a case study in China', Ying Zhan, Rongyi He and Winnie Wing Mui So report on a mixed methods study for which 'drawing and telling' and survey methods were adopted to reveal children's learning during a water conservation education programme. The final two papers in this issue are concerned with mathematics in early years education. In another article from Sweden – 'Collective but not joint: Exploring collective and individual perspectives on preschool mathematics within a professional development programme' - Hanna Palmer compares teachers' views about their goals for mathematics teaching in a preschool at different points during a professional development programme. The final article of this issue focuses on 'Using mathematics games in preschool settings to support the development of children's numeracy skills'. Caroline Cohrssen and Frank Niklas report on a study for which a pre-post intervention design was used to explore the impact on children's learning outcomes of attending a preschool setting in Australia which used a programme of play-based games underpinned by mathematical concepts.

The articles in this issue are a powerful indication that STEM learning is a prominent and valued feature of twenty-first century early years education across the World and I am pleased to commend them to you.

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