‘Early years STEM’: A special edition of the journal *Early Child Development and Care*, to be edited by Helen Bilton, University of Reading, and Mike Watts, Brunel University London.

Editorial

This special edition of *Early Child Development and Care* follows relatively quickly on the heels of the special edition of ECDC in 2017, in the belief that there is considerably more to be said on the topic of early science – and in this case STEM - education. For example, in January 2018, Her Majesty's chief inspector told an audience of science educators at the UK’s Association for Science Education that undue focus on examinations and school league table performances has seen reception class and primary teachers in England focus on English and mathematics, and so "forfeiting a deeper education in science and other subjects". While we may not cavil too much about that comment, we do debate her second contention. Citing analysis from the OECD, she went on to suggest that enquiry-based learning such as designing and completing practical activities might be less effective in early science than teacher-led class demonstrations. In this special edition of ECDC, we have departed solely from early science education, and have broadened this to Science Technology, Engineering and Mathematics (STEM). We have invited contributors to bring theory and practice to bear on rehearsing or refuting discussions and implications on school policy and practice, to advance the study of STEM with young children in a variety of early years settings, in the UK and abroad. To this extent, we have a very broad sense of early ‘emergent STEM’, in a variety of environments, both indoors and out.

Our approach does rather beg the questions of ‘What is STEM?’ and ‘How might this be relevant to early years practice?’ First, the key emphasis of STEM education is less a juxtaposition of the four separate initials S-T-E-M, each one being treated as a discrete component, as an integrative approach that draws on the capabilities and ‘affordances’ of each of the four in combination. Such integrative STEM education tends to encompass real-world ‘authentic’ problems. Therefore, second, STEM education has a strong hands-on group-minded team-based problem-solving flavour, which generates multiple possible answers and reframes moments of failure as a necessary part of learning.

There is considerable pressure from government and various august bodies (such as the Royal Academy of Engineering, the Institute for Mechanical Engineers and Engineering UK (Lucas et al., 2014)) to increase the number of young adults entering the STEM workforce. As is the norm, this pressure works its way inexorably down the education system to primary schools and now into early years settings. At one level, STEM does give a label to what teachers and colleagues are already doing in nursery classrooms - helping children to explore, observe, ask

questions, predict, integrate their learning. It is commonplace in some early childhood education. So, the answer to should there be STEM in this early-years foundation curriculum? is that it is there, of course. It appears in the form of early number work, the M of STEM. Moreover, as we can see in the papers to follow, there is outdoor play in natural settings, block play, fabric boxes, cooking utensils, Lego and Meccano construction kits, mud kitchens, nature tables, water play and sand pits – to list just a few of the exploratory provisions that good pre-school specialists make. If we include visits to local parks, city farms, riverside walks, study centres and the like, we can make a reasonable case that these also cater for some of the S, T and E in early STEM – even if nursery teachers wouldn't recognise this as such. Being open to children's questions allows for STEM concepts to be developed in everyday interactions, and making the links explicit to the children also lets them understand the 'work' they are doing. There is still a perception that to do science, there needs to be big experiments and lots of equipment, but the papers we have collected together here give lie to this - these hands-on STEM activities embrace a wide range of experiences. For example, they enhance cooking, block play, sensory table exploration, field trips and outdoor time amongst many others.

The theme of outdoor activities flows through many of the contributions here. Helen Bilton focuses on outdoor activities and teachers' values, and the conditions necessary to foster good outdoor experiences. She raises the point that, in the UK, early year practitioners are expected to make provision in two different learning environments, that of inside and out, thereby needing to have pedagogical knowledge of the outdoors and subject content knowledge such as science and the environment. Nalda Wainwright and colleagues also look at outdoors education in the environment in Wales -– one theme being about 'stones' - but through the focus of play, what they call a 'playful pedagogy'. Sue Dale Tunnicliffe and Eirini Gkouskou also use books and stories provide a taxonomy of the many outdoor play activities that can be incorporated in science. Suzana Cinthia de Medeiros Silva and Marly Oliveira take the outdoor theme a step further, using their preschool setting to study 'traffic' in their city of Passira, Brasil. Orally and through drawings, the children expressed their understanding of the main means of transportation in the region. They then observed the use of traffic signals to regulate rules and good driving – an innovative approach to STEM in real life situations.

Karen McNerney's project has been based on the premise that science should not be seen as a formal, discrete subject but as part of the overall and holistic nature of young children's development and a means to improve scientific enquiry skills through children's play. Children are naturally curious and we can use this curiosity to place science as part of their everyday observation and exploration. Specifically, scientific enquiry is a very good way of enhancing

that curiosity whilst developing scientific skills as well as acquiring knowledge. Like Karen, Saima Salehjee, trades on children's innate curiosity and develops science enquiry-based learning in nursery classrooms through stories and story-telling such as 'Curious George' and the 'Choc River Ride'.

Emma Wiliams and Nicola turner give a very strong sense of the everyday work at their London school, with an extended discussion of the virtues of the mud kitchen. It is work that has clearly bolstered their own confidence in their own science literacy as they have been adapting classrooms for more free-flow and extended work. In Portugal, Sara Pereira and her colleagues developed a 'materials Lotto' to develop skills and knowledge of materials and 'what things are made of'. Again, their work used an element of play, developing skills and positive attitudes as they worked with children. Materials is also the theme of the paper by Saima Salehjee and Mike Watts in their analysis of early STEM frameworks.

These articles are all exemplary in their own way, without ever exhausting the possibilities of early years STEM.

References

Lucas, B., Claxton, G. & Hanson, J. (2014) Thinking Like an Engineer. London: The Royal Academy of Engineering. Available at: http://www.raeng.org.uk/publications/ reports/thinking-like-an-engineerimplications-full-report

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