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Editorial on Focus Issue: Play in Early Childhood Science Education

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Play has long been a significant part of early childhood education. Throughout history, different societies have adopted play in the curriculum to evoke excitement and participation (Saracho & Spodek, 1995; Smith, 2009). The concept of play has evolved to become a theoretical construct used to frame the analysis of what children do as they learn (Fleer, 2013a). Situated in the early childhood literature, play is not purely about engagement in an activity for recreational purposes. Rather, play encapsulates a philosophical stance, pedagogy, approach, or teaching strategy that taps on the natural curiosity of children, about new objects and events happening around them and inclination to have fun (Fleer, 2013a, 2017). I introduce the evolving concept of play using the theory of emergence (Ablowitz, 1939; Boutillier, 2013) to show the versatility of the concept of play as illuminated through the existing literature and the three studies of this focus issue on *Play in Early Childhood Science Education.* Accordingly, I will first discuss the theory of emergence, followed by an overview of the literature of play in early childhood science education literature. Then, I describe the three studies featured in this focus issue and highlight how they contribute to the emergent literature on play in science education research.

According to a paper that was published by Reuben Ablowitz (1939) more than 70 years ago, central to the concept of emergence is the idea that the whole is more than the sum of its parts. More importantly, there are different levels of existence such that the units of one kind tend to combine to constitute units of a new kind. The latter is more complex and comprises of new qualities due to the different parts put together. As the emergent properties are non-additive, it will be difficult to foretell definitively and exhaustively what would be the

"resultant" based upon the properties of the individual entities that constitute the new whole. These properties continually evolve into higher levels of existence with each level manifesting into something new in the universe to create new novelties, "a new mode of *relatedness"* (Ablowitz, 1939, p. 142; emphasis added). To explain these ideas, Ablowitz gave the example of the chemical reaction between hydrogen and oxygen. I will use the same example to elaborate on his idea below.

Hydrogen and oxygen exist as diatomic molecules (H_2 and O_2) in their elemental form. Under suitable conditions, they react to form water molecules (H_2O) as represented by the following equation:

$$2H_2\ (g) + O_2\ (g) \rightarrow 2H_2O(l)$$

The "resultant", which is water (H_2O), has higher boiling and melting points than its constituent elements, H_2 and O_2, because the intermolecular electrostatic interactions (hydrogen bonds) between H_2O molecules are relatively stronger than those (induced-dipole induced-dipole interactions) between H_2 molecules and between the O_2 molecules prior to the reaction. This example shows that: (1) the properties of the new whole (i.e., H_2O molecule) is not an accumulation of the properties of H_2 and O_2; (2) there is "relatedness" as the electrons in H_2O molecules are from its constituent atoms; and (3) novelties constantly emerge as scientists have found that H_2O molecules will self-ionise as represented by this equation:

$$2\ H_2O\ (l) \Leftrightarrow H_3O^+\ (l) + OH^-\ (l)$$

As the self-ionisation process of water is dynamic and reversible, their existence or outcome, is temporal, unpredictable, and non-deductive (Boutillier, 2013).

We can see how the theory of emergence can be used to describe the current state of the early childhood science education literature about play. Specifically, this field of study emerged from the integration of the early childhood, science education, and play literature.

Applying the disciplinary lens of science into early childhood education and play has generated a field of study in science education research. The scope of studies about play in science education is vast and includes studies that examine different types of play (e.g., spontaneous play, imaginary play, pretend play, role play, guided play, and free play), factors affecting play (e.g., types of learning artefacts), play in diverse contexts (e.g., museums, homes), and policies on play education. For example, Morrissey (2014) conducted a longitudinal study on 21 Australian children aged 8 to 17 months and studied the frequency of pretend play when the children interacted with their mothers. She found that the children's level of pretend development was markedly advanced in terms of age-typical expectations. She argued that the use of abstract play materials was a contributing factor to the child's pretend play development. McGregor (2012) studied the experiences of 20 teachers who used drama as a pedagogy to help children aged 5-7 learn science. He showed that drama is a novel and participatory approach to learning that would develop sustained positive attitude towards science and support the development of firmer understandings about science.

The three papers in this focus issue contribute to the emerging field of play in early childhood science education research in several ways. First, the studies are grounded in different paradigms and involve diverse types of participants from different geographical regions. The first paper by Tang Wee Teo, Yaw Kai Yan, and Monica Ong identifies young children's alternative conceptions through play. Their work marries the field of study on children's science conceptions and early childhood literature on play pedagogies. The context of this study was in a formal kindergarten classroom for Singaporean children aged 6. They were guided by adults (researchers and/or kindergarten teachers) to participate in the purposeful play activity on floating and sinking. Using play as the platform, the children's conceptions of floating and sinking were elicited. The reason for using play and not traditional data collection methods such as surveys, questionnaires, pre-tests, and post-tests,

was due to the limited written and standard English proficiency of the children. Through this study, a new children conception that has not been previously reported in the literature was identified, hence, contributing to this field of study that underscores the emphasis of play and not academic achievements in the early childhood curriculum (Fung & Cheng, 2012). Additionally, the authors intentionally used the term “emerging conception” to acknowledge the children’s nascent and evolving ideas about floating and sinking as they have not received formal science education (at Grade 3, aged 8).

The second paper by Yijun Hao and Marilyn Fleer shows how play transcends formal learning contexts into informal learning context of the homes of children. Science education of young children thus is not limited to the boundaries of the classroom but crosses into the personal space to form a continuum of learning spaces. In positioning the parents in their study as co-researchers, there was blurring of the researcher-participant roles and the parents were empowered to learn parenting skills for their child’s science education in China. Framed using the cultural-historical theory, learning in imaginary situations becomes valued as a legitimate way to learn.

The third paper by Josephine Shireen DeSouza shows how affordances were created through the design of inquiry-based activities using the modified 5E (engage, explore, explain, elaborate, and evaluation) instructional model (Bybee, 2014) and implementation of the activities in a natural and outdoor setting located within the campus of a Midwestern U.S. university. The openness of the context allowed for free play and pretend play to happen as children designed bird habitats (nests) made from different materials, while considering the species of the bird and food source. In contrast to the paper by Tao and Fleer, DeSouza drew upon the Vygotskian (1978) theory on the zone of proximal development to make sense of the children’s imaginary play guided by rules.

In sum, this focus issue illuminates the emergence of the field of play in early childhood science education and invites more scholars to continue the discourse. The diversity of paradigms illuminates the intersectionality of *play* with social, cultural, historical and cognitive factors and brings us to an important point: While *play* appears to be a universal concept that describes how most (if not all) young children learn, it is essentially a situated construct. Because of the fluidity and diversity of context, *play* can never be discussed in isolation of time, space, place, people, history, and culture.. Play continues to evolve as these elements change. Collectively, these papers will inform early childhood educators, teachers and researchers, and parents about different ways to frame, study, and understand *play* in early science education in this emerging field.

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