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Early childhood education draws on a long tradition of play-based curricula. In contrast, mathematics is often regarded as a formal academic subject found in school curricula. Neither of these positions is absolute. Play is an important vehicle for young children's learning, though it is not the only way that young children learn. Mathematics is also a focus of young children's learning and, indeed, young children have developed a wide range of significant and powerful mathematics understandings well before they start formal schooling. Many of these understandings will have developed and been refined through play.

Play provides a valuable social context, where interaction with more knowledgeable or experienced others can be promoted. This is the basis for scaffolding (Bruner, 1986), or guided participation (Rogoff, 2003), where the social interaction as well as the play focus help make sense and create meanings within a particular context. With social interaction providing support and the play context creating a situation where innovation, risk taking and creative problem solving can all be encouraged, young children learn a great deal about themselves, others and the world in which they exist. The social and cultural contexts of play provide the framework for the understandings that are constructed. Vygotsky (1978) described play as creating a zone of proximal development (ZPD) where children were motivated to learn and encouraged to do so by the assistance of more experienced others.

Play has also been described as an integrating mechanism (Bennett, Wood & Rogers, 1997), providing a context where children can draw on their past experiences, make connections across experiences, represent experiences in different ways, explore possibilities and create meaning. In themselves, these processes of play have strong links to mathematical thinking. The processes are often complemented by mathematical content of children's play.

Johnson (1990) summarises the importance of play when he notes that play "not only reflects or is a window on child development but also contributes to it both by consolidating or reinforcing recent learnings and conceptual acquisitions and by providing opportunities for new masteries and novel insights" (p. 214).

Young children's play can be incredibly complex. Such complexity can be seen in the themes of play, the actual content, the social interactions involved as well as the understandings demonstrated and generated. Mathematical experiences abound in children's play. Ginsburg (2000) for example, identified mathematical experiences in 42% of all the observed play among a group of four to five-year-old preschoolers. Some areas of play have been particularly linked with mathematical learning, notably block play, sand play, water play and dramatic play but all play has mathematical potential (Perry & Conroy, 1994).

The role of the educator in promoting play is pivotal. On one level, the adult sets up the structural environment for play, providing appropriate physical props, space and time for play (Dockett & Fleer, 1999). Just as important as the physical context is the

psychological context, which establishes the general atmosphere and tone of the learning environment. Children are much more likely to engage in play and to develop complex play in an environment where they know that making mistakes is tolerated, where their efforts (as well as their products) are respected and encouraged, and where they can interact in meaningful ways with people who are important to them. Personal respect is also a key element of such learning environments, where individuals (children and adults) each have the right to share their own understandings and to be heard.

The role of the educator is also pivotal in promoting both play and mathematics learning. In some contexts, there is a sense that children's play is best left uninterrupted by adults, whose role is to observe but not interact. There is no doubt that observation of children's play is an important part of an educator's role. However, more complex play is likely to develop when adults have an active role. This does not mean that adults have to become players alongside children. Rather, when adults adopt the role of provocateur (Edwards, Gandini & Forman, 1998) they not only observe and assess the understandings of children, they also generate situations which challenge these. This may involve asking questions, introducing elements of surprise, requiring the children to explain their position to others and working with children to consider the logical consequences of the positions they adopt. Asking "what if?" questions is a great way to start these sorts of conversations.

It is also important to note that playfulness is itself a disposition, or a general habit of mind. The best way for children to adopt such a habit of mind is to observe it in others. Children learn to be playful around adults who demonstrate their own playfulness, much as they learn other dispositions, such as curiosity, creativity, caring, responsibility and initiative, by being around others who demonstrate the same dispositions. Educators who demonstrate both their own ability to play and their disposition to use mathematics in everyday situations and interactions, promote these same dispositions among children.

Many educators think of play and then think immediately of chaos. There is no doubt that sometimes, play can appear chaotic. One of the central features of play is that it makes sense to the players. The corollary is that it may not make the same sense to the observers. Appreciating children's play requires time to become familiar with the players, their contexts and the nature of their play. Such an understanding is critical if educators are to build on such play and add complexity through introducing additional possibilities through props and supports.

In some contexts, free play, where children have a wide range of choice and plenty of time and space in which to play, is the logical way to promote children's engagement in experiences that are meaningful, relevant and interesting for them. In other contexts, play assumes a more structured face, where time, space and materials may be more limited. Sometimes, this is called structured play, or directed play. While there is a danger that structured play can become overly adult-directed, and so not be play at all, there is also the possibility that structured play can support children as they explore possibilities, construct meanings and test these out with people who matter to them, revisit understandings and experiences, engage in scripting, modelling, organising, sequencing, representing, creating, extending and socialising — all of which can be powerful mathematics experiences.

References

Bennett, N., Wood, L. & Rogers, S. (1997). *Teaching Through Play.* Buckingham: Open University Press.

Bruner, J. (1986). *Actual Minds, Possible Worlds.* Cambridge, MA: Harvard University Press.

Dockett, S. & Fleer, M. (1999). *Play and Pedagogy in Early Childhood: Bending the Rules.* Sydney: Harcourt Brace.

Edwards, C. P., Gandini, L. & Forman, G. E. (1998). *The Hundred Languages of Children.* Greenwich, CN: Ablex.

Ginsburg, H. P. (2000). *Children's Minds and Developmentally Appropriate Goals of Preschool Mathematics Education.* Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, April.

Johnson, J. E. (1990). The role of play in cognitive development. In E. Klugman & S. Smilansky (Eds), *Children's Play and Learning* (pp. 213–234). New York: Teachers College Press.

Perry, B. & Conroy, J. (1994). *Early Childhood and Primary Mathematics.* Sydney: Harcourt Brace.

Rogoff, B. (2003). *The Cultural Nature of Human Development*. Oxford: Oxford University Press.

Vygotsky, L. S. (1978). *Mind in Society*. Cambridge, MA: Harvard University Press.