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Supporting children's development

Problem solving and mathematical thinking

In this article on supporting children's development, Jan McFarlane describes the importance of problem solving and mathematical thinking in the development of children's life skills.

Children are naturally curious and eager to discover how the world works, and every day life presents many opportunities for active exploration and learning. Constructing new learning is also a social activity, and children's interactions with their families, other children and adults help them to make sense of, and build on, their discoveries.

Children's play provides rich possibilities for hands-on exploration and opportunities to test out new theories and ideas. When children share their explorations with others their joint investigations can often create more innovative solutions to a problem than those created by the child exploring alone.

Our role as child care professionals is to create the environments and experiences that encourage children to become effective thinkers and problem solvers.

Learning important life skills

Children's early play experiences lay the foundation for more formal learning about literacy, mathematical and scientific concepts in school settings. For example, a toddler squeezing themselves under a low table, a preschooler building a tower with blocks or a school age child involved in a cooking activity are all experimenting with mathematical concepts such as shape, size and space.

In our rapidly changing world, flexible and creative thinkers will be vital. Children who are confident to experiment through trial and error and who persist when they find something difficult in their play experiences are likely to apply these same learning strategies and dispositions in school and beyond.

Maths is more than numbers and counting, problem solving is a thinking process used in all areas of learning – not just to work out numerical problems. Both involve being able to develop a hypothesis and explore a number of possible solutions by comparing and estimating, and recognising shapes, patterns and relationships.

This article relates to:

FDCQA Principles:	2.2, 3.2 and 3.6
OSHCQA Principles:	4.2, 4.3 and 5.3
QIAS Principles:	3.2, 3.3, 4.1 and 4.4

Finding an innovative solution to a problem is satisfying and leaves children feeling good about themselves and their ability. They will increasingly be ready to 'have a go' when faced with a new challenge and want to take responsibility for their own learning.

Babies

Babies learn to make sense of their world by investigating their environment through their senses, movement and their interactions with people. Anything that they can reach or see becomes something they can investigate. They use all their senses to find out what it does and what they can do with it.

Sensory experiences, such as playing with a simple rattle or toy, mouthing it, passing it from hand to hand, using hands and feet to bat or kick it, or finding it hidden under a piece of fabric, build understanding. Babies are learning about their own ability to influence what happens, and are also discovering interesting things about size, shape and motion.

Similarly, a baby is building a database of information about spatial concepts, counting and patterns, as well as the value of warm relationships, as they enjoy a rhyme and game with their parent or carer.

The range of opportunities for learning increase significantly when babies begin to crawl and they are able to find new things and new places to explore.

Toddlers

As they are able to walk, toddlers can explore further and engage in physically active and often boisterous play. Toddlers become absorbed in their play, repeating actions and sustaining their efforts until they are satisfied that they understand

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what things mean and what they can do. For example, a toddler may fill containers with sand or water, empty them and fill them again and again. While the child is learning the properties of these natural elements they are also beginning to discover shape, size and volume.

Toddlers often need support from adults to sustain and extend their investigations and to recognise their achievements. These relationships give them confidence to take on new challenges, take risks and tackle new situations with enthusiasm.

Preschool age children

Between the ages of three and six children show a great deal of curiosity, ask lots of questions and are interested in why things happen. They are able to describe and share their thinking with other children and adults who join in their exploration of new theories.

Given the opportunity, preschoolers will enthusiastically initiate and direct their own play, making decisions about what they do and how they will go about it. These experiences afford opportunities to develop independence and confidence in their ability.

Preschoolers' play is often complex, and can extend over long periods of time, particularly when they are exploring things that interest them. A good example is the complex imaginative play which often incorporates stories or characters from television and DVDs. This type of play provides infinite opportunities to reason and problem solve, as well as to explore language, science and mathematical concepts. When it is guided and supported by child care professionals, imaginative play can also foster children's skills in negotiating with peers, resolving conflicts and learning about the impact of decisions on others and what is fair. These are valuable lifelong skills.

School age children

Children's understanding of the world expands as their experiences broaden at school and in their local community. Relationships with their peers also become increasingly important during middle childhood, as well as children's confidence in their ability to be responsible for themselves.

Over time, school age children begin to think and reason more like adults. They are able to consider complex problems, often involving abstract concepts, and apply logical thinking and experiment with a number of possibilities to reach a workable solution.

Children's increasing ability to concentrate on things over a longer period of time and more highly developed planning skills mean that they can have greater input in the development of the outside school hours care program. School age children become enthusiastically engaged in real and meaningful projects that they have instigated. These projects also provide practical opportunities to reinforce the reading, writing and numeracy skills they gain in school. For example, they may be involved in planning the menu for afternoon tea by surveying children's ideas and preferences, researching healthy food options, collecting recipes, developing shopping lists and managing a budget.

Scaffolding children's learning

Children's services provide a wealth of opportunities for children to develop and use mathematical thinking and problem solving skills.

Creativity and inventiveness flourish when children have:

Sufficient space to explore and investigate. We can support children by consulting with them about how spaces will be used and helping them to arrange the environment to support their emerging interests.

Time. This allows children to play, and to explore materials, consider their properties and test out what they can do. When routines are planned so that there are long periods of uninterrupted time, children can become fully engaged in their investigations. Similarly when areas can be left set up throughout the day or overnight, children can revisit the same experience for further exploration, building on their previous discoveries over time.

Access to many resources. These can include a variety of open-ended, natural and found materials. For example, fabric remnants, blankets, scarves, boxes, baskets, timber off-cuts and plastic pipes and tubes. Well organised storage containers and materials that are presented attractively and can be accessed independently by children lend themselves to innovative thinking. There is no wrong or right way to use open-ended materials and this freedom allows children to use them in new ways, guaranteeing success.

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Tools. These can include rulers, tape measures, scissors, tape, staplers, pliers, screwdrivers, spanners, cooking and gardening utensils, for children to create and construct independently. Child care professionals need to teach children how to use tools safely.

Opportunities to be involved in everyday experiences. For example, laying the table, folding the washing, following a recipe, serving food, planting a garden or planning an event. These experiences can encourage children to solve problems and use mathematical thinking.

Maths-based experiences. There are many songs, rhymes, picture books and games that will help children to think about mathematical ideas and predict what might happen next. For older children, board and card games build an understanding of concepts such as chance and probability.

Opportunities to work with other children. Collaborative play experiences can provide children with valuable lessons about ways to share ideas, consider other people's points of view and negotiate when problem solving.

Help to reflect on their discoveries and share them with others. Encouraging children to talk about what they are doing and wanting to achieve, helps adults to understand children's ideas. Offering suggestions and posing questions can help children to extend their thinking and take their ideas forward. Sharing photographs of works in progress and carefully documenting children's experiences can also help them to overcome design problems and generate new ideas.

Adults sharing children's sense of wonder and curiosity. We can help children to find possible solutions to the difficulties they encounter in their play by modelling curiosity, asking questions and allowing children time to come up with a solution, even if it takes some time to find one that works. For example,

'I wonder how.....?',

'What will happen if.....?',

'What else could you do....?'

Conclusion

All children can be creative thinkers and problem solvers when we plan environments rich with possibilities, and when we respect and value their ideas. Children who are able to initiate their own experiences and are supported to make their own discoveries are likely to find the learning that takes place satisfying and meaningful. When they are able to share their discoveries, and others delight in these too, children feel capable and competent. This sense of confidence and capability gives them confidence to approach new challenges with enthusiasm ■

References and further reading

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Useful website

- The Early Childhood Learning Resources Project: www.deewr.gov.au/EarlyChildhood/Resources/Pages/EarlyChildhoodLearning.aspx