Bishop's mathematical activities

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Alan Bishop (1988) has described six fundamental mathematical activities: Counting, Locating, Measuring, Designing, Playing and Explaining. According to Solem and Reikerås (2017), these activities can be seen in children's mathematical investigations and in early childhood experiences.

Children's mathematical activity

Children's mathematical activity is also the basis for the subject area Number, space and shape in the Norwegian Framework Plan for Kindergartens (Ministry of Education and Research, 2017).

In the Framework Plan, the mathematical focus is on: number, space and shape. Bishop's activity of counting is in alignment with number, Locating can be connected to space, and Designing is about shape. Bishop's other three activities are seen across the framework plan's focus. Measuring is related to both number and space, and Playing is about trying our strategies and posing problems. These activities can be related to number, space and shape. In the same way, Explaining is about describing what you are doing and why, and therefore this mathematical activity can also be linked to number, space and shape.

In the Framework Plan, staff are to work with children to develop their mathematical understanding. Observing and engaging with children gives staff insights into children's mathematical development and knowledge. A way to do this is with digital toys, such as robots. Robots can stimulate children's curiosity and support their problem-solving, for example with a BlueBot, like the one shown in the picture. Having children work with robots provides staff with opportunities to introduce and reinforce appropriate mathematical language for describing what the robot does.

Counting

Bishop (1988, p. 182) stated that counting is "The use of a systematic way to compare and order discrete phenomena. It may involve tallying, or using objects or string to record, or special number words or names."

Although counting is a valued skill, the connection to children's everyday activities is often not easy to see. Instead, children are asked to count things just for the sake of counting. For example, "how many children are there today?" provides an opportunity to count children but does not show how counting could help them solve particular kinds of problems.

As the Norwegian Framework Plan (Ministry of Education and Research, 2017) highlights the importance of children's lives being enriched with mathematics and encourages them to be curious, children should have opportunities to work with problems that can be solved with counting. The use of robots, such as the BlueBot, can create a genuine need for counting, as each movement of the robot provides information about how far forward (or backwards) the robot goes.

Locating

Bishop (1988, p. 182) described locating as "Exploring one's spatial environment and conceptualising and symbolising that environment, with models, diagrams, drawings, words or other means." It is, thus, easy to see how it is related to understandings about space.

Representing their environment with maps, provides a way to experience how three dimensions can be recorded and interpreted in two dimensions. Working with robots also provides an opportunity to add appropriate words, such as left and right, forward and backwards, to what children see the robots doing. These words can also be used by children to programme each other, as pretend robots, to move along specific paths.

Measuring

For Bishop (1988, pp. 182-183), measuring is about "Quantifying qualities for the purposes of comparison and ordering, using objects or tokens as measuring devices with associated units or 'measure-words'."

Children often engage in problem solving tasks which involve direct and indirect comparison. Direct comparison can be done by placing two items side-by-side to see which is the longest. Children can explore if a robot is taller or shorter than another object, by for example, programming the robot to drive under a bridge built with blocks. In indirect comparison, a specific unit of measurement is used. In the image, the child uses their hand to measure how many times they have to push the Rugged robot to get it all the way down the hill.

Designing

The Norwegian Framework Plan (Ministry of Education and Research, 2017) interprets designing to be mostly about children's learning about shapes. However, for Bishop (1988, p. 183), designing was more about developing mental images. Bishop stated, "Creating a shape or design for an object or for any part of one's spatial environment. It may involve making the object, as a 'mental template', or symbolising it in some conventionalised way."

Children often put different objects together when they are playing. In this picture they have set up two fences on the board which will affect the choices they make when they code the Kubo. The design of the objects gives children opportunities to explore how different shapes can be placed together, but also how different properties contribute to the function of the object. For example, children could be curious about the design of different kinds of robots such as about the curves on the wheels and how it helps the robots to move.

Playing

Bishop (1988, p. 183) described Playing as involving "Devising, and engaging in, games and pastimes, with more or less formalised rules that all players must abide by."

Playing can be connected to problem solving, which is emphasised as important in the Framework Plan. This is because both Playing and problem solving involve engaging in "what if"-scenarios to consider different possible outcomes (there is a need to think about what to do before you actually do it). The children in the picture must, for example, think about how they can place the Diplo figures on top of the robot, Cubetto, before they actually do it.

Children's play with robots can often involve them setting up scenarios about how to solve different problems which they can discuss before trying them out. These could be about planning a route for the robot which could involve going over or under bridges. Often this kind of Playing involves the children posing their own problems, rather than just solving problems given to them by others.

Explaining

For Bishop (1988, p. 182), explaining is about "Finding ways to account for the existence of phenomena" and so can be about discussing, explaining and justifying mathematical ideas.

Children's engagement in the world provides many opportunities to engage in explaining. Early childhood staff can support children to explain what they are doing and why. For example, with problem solving, children can be asked why they think a solution strategy is the best one.

In providing explanations, children can be encouraged to use mathematical terminology but also to use gestures and the actions of physical objects to add other meaning to those explanations. This can be seen in the picture where the children point and describe the robot's route, while it is being drawn. Activities with robots can provide many opportunities for children to discuss what the robot is doing and why they think it does this.

Summary

In this text, I have discussed Bishop's (1988) six activities and how they relate to children's mathematical experiences and interests. These are linked to the requirements of the Norwegian framework plan (Ministry of Education and Research, 2017) and the importance of children working with understandings about number, space and shapes.

Robots can provide children with a range of experiences related to Bishop's mathematical activities. To support children in their mathematical development, these experiences with robots can be integrated with other experiences, such as role play, and everyday experiences.

References

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