MADGE SEXTON KINDERGARTEN

JULY 2019

STEM EARLY YEARS

ROBOTS ALIVE project: One site's story

INTRODUCTION

Madge Sexton Kindergarten was one of four sites that took part in the Robots Alive collaborative research project. The project set out to investigate the possibilities for young children to develop the knowledge, skills, dispositions and understandings inherent to learning with, and about, digital technology. A key component of the project was a robot called Cubetto, which was introduced to the children for them to explore.

THE WONDERING

Educators came together as a team to discuss the project, to elicit their initial thinking and identify potential challenges. Questions were raised about the educators' understanding of coding, the pedagogical approaches needed and the children's existing knowledge of robots.

After reflecting together, the educators decided their pedagogical approach would be to research and learn alongside the children. It was agreed that they would introduce the robot Cubetto after a discussion about robots more generally. Informed by their question **"What do children already know about robots and how they work?"**, the educators began collecting base line data.

The children were invited to explore their ideas about robots through drawing and sharing, and they revealed some existing understanding of robots. To explore this thinking further, the children were given a range of machines to open up and tinker with. They investigated the small parts and began to hypothesise about what was really going on inside these machines.

EDUCATOR DOCUMENTATION: SNAPSHOT 1

Exploring ideas about robots: Children and educators as co-researchers

EDUCATOR WONDERING

What do children already know about robots and how they work?

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Educators asking children to share their working ideas about robots.

"Some have wheels."

"The robot goes down into the volcano. It's not safe for people."

"They can sweep up and make dinner."

"A robot is a machine."

"You have a remote control and make them move."

"Robots help us."

"You need to make a plan first, before you build one."

THIS LED TO

Educators providing children with tools and loose parts to explore and explain their ideas further.

"Maybe we can build our own robot."

"There is a motor inside."

"If you tell it to do something, it will."

"There's wires. They're for making it work."

THIS LED TO

Educators picking up on a common theme in children's ideas and wonderings:

"If you tell it to do something, it will."

From these initial ideas, wonderings and investigations, educators and children established the following research question to investigate: **"How do we tell robots, like Cubetto, what to do?"**

Government of South Australia
Department for Education

THE RESEARCH

With a research question to investigate, the children were introduced to Cubetto. They were provided with long, uninterrupted periods of time over many weeks to test their hypotheses and inquire about what was possible with Cubetto. The educators scaffolded children's discussions, showing genuine interest in the children's perspectives and ideas, and observed children identifying code as a series of steps.

EDUCATOR DOCUMENTATION: SNAPSHOT 2

From robots to robotics: Children as computational thinkers

EDUCATOR WONDERING

Is Cubetto an appropriate robotic tool for children to develop computational thinking and an understanding of coding?

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Educators providing children with time to collaborate, develop ideas and problem solve with Cubetto.

"The arrows on the row mean point it this way."

"It moves when you put the tiles on... different colours."

"Turn on the switches, press the button, it moves."

"Cubetto is about making patterns."

"When you take a tile out, the light goes off."

"Does clapping make Cubetto move? Maybe it will move if we sing to it."

"Look there's a map, it tells you stuff."

"The green one makes it go forward, the blue one is a surprise."

THIS LED TO

Children discovering Cubetto collaboratively, through play.

Children sharing their wonderings and working ideas about how to talk to Cubetto and discovering ... code.

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Educators observing children experimenting with code and naming code as a series of steps.

"Oh, I can control it."

"The code makes it go. A code is when you put things in and it does it, like a password."

"A code makes robots work."

THIS LED TO

Educators relaunching one child's idea:

"A code makes robots work."

As the children familiarised themselves with Cubetto, it became apparent that, in order to effectively program Cubetto, the children needed to further develop an understanding of specific elements of computational thinking, including position, location and direction. Educators responded, providing opportunities for children to 'be' Cubetto and working with maps and mapping to explore movement and positional language. They also created small table play, with storybook provocations, providing unplugged opportunities for children to code, debug and problem solve. The educators noticed the children engaging in design thinking as they identified a problem and planned a solution. It became evident they were able to transfer this new knowledge as they began to program Cubetto with purpose.

EDUCATOR DOCUMENTATION: SNAPSHOT 3

Children as coders: Exploring coding through play

EDUCATOR WONDERING

What is children's understanding of code?

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Educators exploring and identifying children's technological thinking and coding in unplugged contexts.

"Around the barn."
"Go forward ... one, two, three spaces."
"Fixing the code will make it work."
"We have to listen to instructions."
"I'm making a code for Rosie."
"You have to work out which way to go."
"Go forward two."
"Code is arrows. They show you the way."

THIS LED TO

Educators providing children with different environments and materials for them to experiment with code.

Supporting children to read another person's code.

Educators providing opportunities for children to make, read and debug (fix) a code.

THIS LED TO

Educators relaunching one child's idea:

"Fixing the code will make it work."

The children explored other possibilities as they played with Cubetto, attaching pens and adding random code to the function bar. The children were continually surprised by the capabilities of the robot. With excitement they named their newly designed piece of technology 'Cube Artist'. Numeracy skills were developed as children identified the shapes that could be created and the patterns needed in the code to create them.

EDUCATOR DOCUMENTATION: SNAPSHOT 4

Children as creative thinkers: What else can Cubetto do?

EDUCATOR WONDERING

Could children use their ideas about Cubetto in new contexts?

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Educators supporting children to explore their ideas about Cubetto in open-ended contexts using new materials.

"A code can be different things."

"It is sort of a Cube Artist."

"Cubetto makes a dot when it stops."

"Green, yellow, green, yellow. Maybe it will draw a square."

"Cubetto can kinda make a love heart shape."

"It's drawing the titanic ship."

"You can make beautiful pictures if you know how which colours go to which sides."

"It's like a road with a roundabout."

"Different things can be artists, maybe robots too."

"You can put pens on Cubetto and press the button."

THIS LED TO

Educators supporting children to engage in design thinking processes.

Educators asking children open-ended questions relating to their code.

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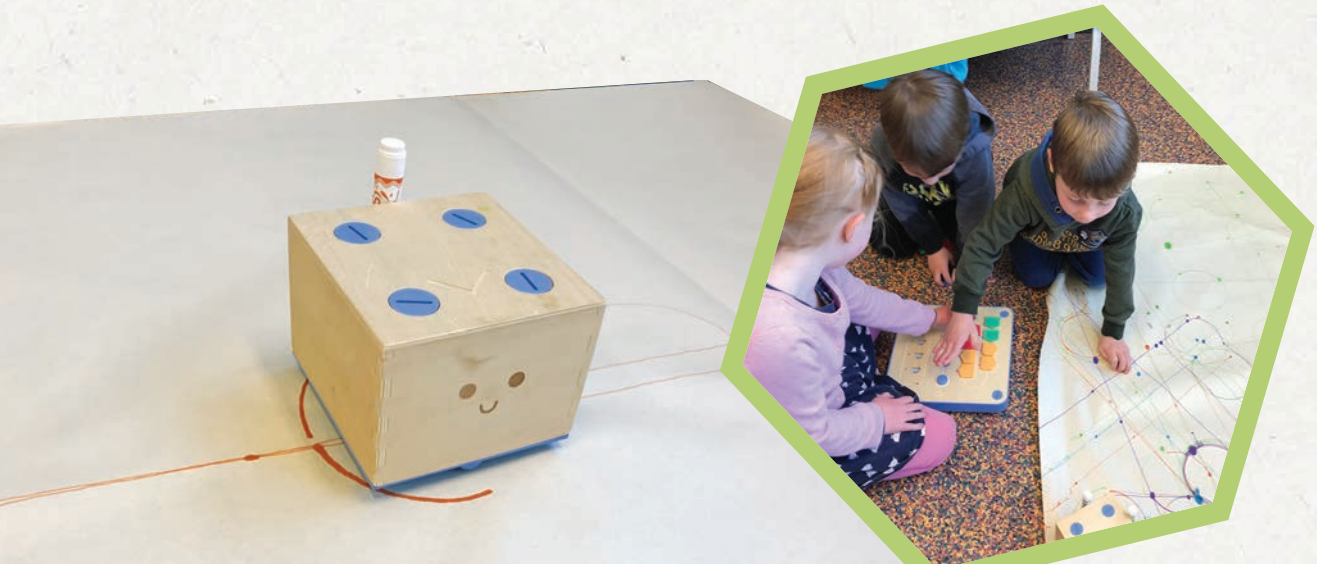
Children's research supporting them to understand and apply coding to new contexts.

"Different things can be artists, maybe robots too."



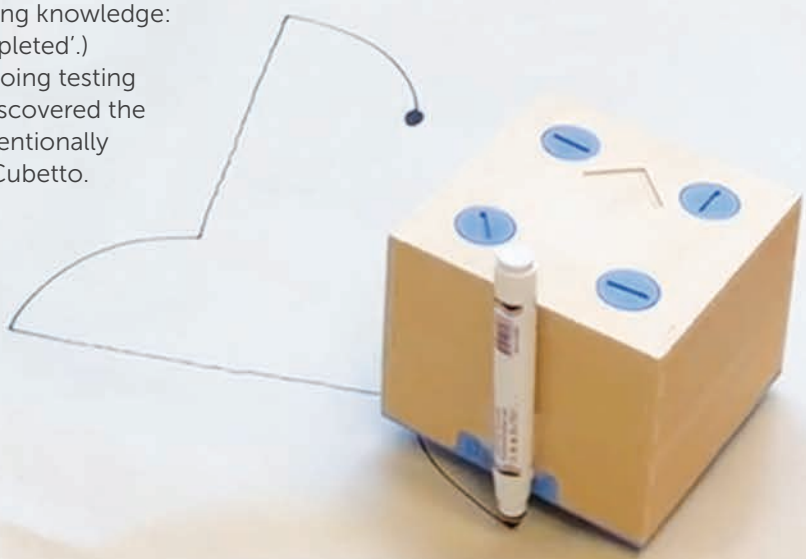
CHALLENGES

The main challenges arose at the beginning of the study as educators deliberated on the entry point into exploring computational thinking. They considered the need to use their existing pedagogy of working from children's ideas rather than stepping children through the instructions that came with Cubetto.

In their initial exploration the children filled all the spaces on the program board with the coloured blocks, based on their working theories that this was a function requirement. (Educators recognised the board resembled a wooden puzzle and that the children were drawing on their existing knowledge: a puzzle needs all pieces to be 'completed'.) Supported through a process of ongoing testing and evaluation (play), the children discovered the diverse ways the blocks could be intentionally inserted into the board to program Cubetto.

DOCUMENTATION

Educators were encouraged to develop methods of digital documentation to make learning processes visible. The Book Creator app enabled timely documentation, collating images, videos and accompanying comments of the children as they played. As such, documentation happened in the moment, rather than at a later date. Regular collaborative analysis of the documentation enabled ongoing formative assessment of the children's learning and understanding.



PEDAGOGICAL IMPERATIVES – LEARNING FOR EDUCATORS

Formative assessment practices and the ongoing documentation supported educators and children to collaboratively reflect and adapt their approaches.

When educators made the decision to learn about Cubetto alongside the children, they created a shared culture of learning together. Children often looked to the educators for answers but were encouraged to discover and develop an understanding of Cubetto's capabilities together. Educators saw the need to develop a common language around coding and robotics to facilitate this new learning.

The research confirmed that educators' existing social constructivist approaches to pedagogy were appropriate for scaffolding children's technological thinking. With educators offering questions rather than directions, "What do you notice?" became the key question.

Other important educator-led questions were:

"The red and yellow blocks both turn, but which way?"

"How does Cubetto move?"

"How do we get from one side of the grid to another?"

"What do you notice about this situation?"

"How do we find out?" and "Do you agree?"

These questions guided children to the understanding that coding was a language that made Cubetto move.

OBSERVED OUTCOMES – LEARNING FOR CHILDREN

Children:

- understood that code can be many things, including a set of instructions
- began to interpret and design their own codes (algorithms or sets of instructions)
- began to apply their understanding of coding to new learning situations
- demonstrated their capacity to debug, by testing their code to solve problems and interpret patterns
- demonstrated the key components of computational thinking.
- developed directional vocabulary and discipline specific language.
- demonstrated technological thinking in plugged and unplugged learning environments.

CONCLUSION

As a result of their Robots Alive investigation, educators at Madge Sexton Kindergarten recognised that young children can develop the knowledge, skills, dispositions and understandings inherent to learning with, and about, digital technology.

The educators came to understand the rich value of co-researching and learning together alongside children. As children learned about coding, educators did too, and a deepened understanding of the ways in which children could engage in 'unplugged coding' began to emerge.

Educators agreed that being able to interpret, produce and debug code (coding literacy), provided children with new ways of thinking, communicating and expressing ideas. Children were able to make meaning of the language of coding in their play, through problem solving and computational thinking.

STEM EARLY YEARS

This paper is part of the 'STEM Investigations: Exploring technological thinking' category.

Further STEM Quest resources can be found at: TLinSA.ti.cc/STEMQuest