Integrating young children's digital play with tangible technologies

(Conference Stream: Designing digital experiences for children)

Panel Leader:
Dr Karen Murcia
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Panel Abstract:
When observing young children, it is evident they find playing with coding toys and robots exciting. Children investigate the world around them as they code robot movements. This play based learning experience opens up demands for computational thinking and requires the development and use of inquiry skills. The presenters in this panel share the view that children learn by doing and that tangible objects support concrete ways of thinking and the development of inquiry skills. This shared perspective brought Researchers from the UK, Australia and the United States together as they investigate Cubetto, an innovative digital coding device's impact on young children's learning and development. Cubetto was created by Primo Toys with a range of floor maps which represent different worlds, from the deep sea to outer space. Exploring the mapped world evokes children's imagination and conversations that link to disciplines such as history, geography and science. It is proposed that the thematic approach changes the experience from a strict problem solving task to a problem finding exercise which gives the child greater autonomy and opportunity for social interaction. Self-reflection and purposeful learning conversations, with an actively listening educator, can assist children to clarifying their thinking, try out ideas and connect to the environment around them.

The perspective of the panel members is that digital learning technologies sit integrated across the learning areas and create provocation for children's inquiry learning and development of transversal competencies. We will share research findings that include insight from the design and development of Cubetto through to its implementation in early years learning environments. Illustrative examples of the curriculum development and implementation processes observed in Australia and the United States will be shared in the presentations. The use of measures of teacher efficacy to help inform teacher engagement and professional development will also be discussed.

Presentation One Title:

Introducing Cubetto: From concept design to the classroom

Presenter:
Mark Overland
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Abstract
Coding is a basic 21st century skill. At Primo Toys we think it should be introduced in the same way as traditional subject, such as numeracy or phonics, starting at preschool level. It should be accessible to both girls and boys, of all cultures, all over the world. Cubetto offers the first tangible programming language specifically designed for children in preliterate years. An inclusive solution that merges LOGO Turtle inspired programming with Montessori hands-on learning principles; Cubetto addresses both the need for learning computational thinking and an authentic learning experience.

Through field research Primo identified three key insights – that children:

1. Learn through play;
2. Are motivated by challenges;
3. Find abstract thought difficult.

These insights, coupled with the traditional play patterns of colour recognition and shape sorting, resulted in the birth of the Cubetto Playset. The outcome of the tangible coding tool was a physical programming interface that facilitates three fundamental principles - sequencing, debugging and functions. To achieve this functionality, two individual products were developed called the interface board and the Cubetto robot. The board facilitated a better physical interaction through a tangible coding interface whilst the character of Cubetto engaged children and emulated a Maslowian construct of creativity developing through purposeful play.

Cubetto meets the educational needs of schools at a time when many curriculums require students to learn computing at the same time they are developing their other core skills such as the 3Rs with a mix of different learning tools. Using prominent researchers such as Piaget and Papert as inspiration, we feel that authentic STEM learning opportunities are structured and scaffold around open learning where students are able to construct their knowledge. Today, however, many children still lack exposure to the fundamentals of computer science at a young age. Cubetto addresses this deficit through hands-on play that makes learning programming more approachable.

Presentation Two Title:

Exploring Our World with Tangible Technologies: Integrating Robotics into Inquiry Project Investigations in Early Childhood Classrooms

Presenters:
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Abstract:
This presentation highlights pilot findings from a study of pre-kindergartners' playful and creative uses of Cubetto to explore the environment around them. While Cubetto was originally designed as a hands-on application for young children to learn coding, it also offers opportunities for children to develop fine motor, communication, logical reasoning, and social-emotional skills. The versatile storybooks and maps used with Cubetto provide educators with opportunities for designing learning experiences that are suited to a variety of classroom topics and academic objectives.

Our research integrated this tangible technology in purposeful ways into the project-based curriculum of our university laboratory preschool. Through the Project Approach the children, ages 3-5 years old, investigate their local surroundings and resources, deeply inquiring into topics evolving from their own interests. The integration of digital play with tangible technologies in the early childhood environment is designed to provide a context for young learners to apply their growing academic knowledge and skills in authentic ways. Papert's theory of constructionism guided the research as we observed how young children build knowledge through the creation of tangible products as "objects to think with" (Akermann, 2001, p. 4). This presentation will focus on the following research questions:

- How does Cubetto serve as an instrument through which children can construct knowledge about map reading and directionality when designing a pathway for travel?
- How can tangible technologies increase children's self-awareness as well as awareness of other students of diverse backgrounds?

- How might cybercitizenship concepts (i.e., following safety rules, protecting personal information, and communicating respectfully with others) be introduced through digital play with Cubetto?

We will share research findings that include data on the curriculum development and implementation processes. The use of measures of teacher efficacy to help inform teacher engagement and professional development also will be discussed. The presenters will highlight strategies to help teachers demystify the process of engaging young learners with tangible technologies while the children learn about themselves and their communities. Using video documentation of the children's interactions, we will showcase how the robotic manipulatives serve as catalysts for peer collaboration, socio-emotional regulation, and creative problem solving.

Presentation Three Title:

Early Childhood iSTEM: Playing as learning with digital technology toys.

Presenters:
Dr Karen Murcia and Dr Lina Pelliccione
School of Education
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Perth, Western Australia

Abstract:
In this presentation we will share case study research investigating how young children learn through play with digital technology toys. The research is timely as there is a national focus on STEM (Science, Technology, Engineering and Mathematics) education. In this current climate, the role of digital technologies in early childhood is increasingly discussed and negotiated in learning centres. Educators are wanting support in understanding how young children can be creators of technology (digital coding) and not simply consumers of products. We argue that important foundation abilities and dispositions are established in the early years and these include essential computational thinking skills and transversal STEM capabilities such as creativity, inquiry, risk taking and communication.

The research was conducted in a long day care centre with 4 Educators and two focus groups of children (ages 3 & 4) selected from their kindergarten program. We used action research methods to work with the Educators as they explored a range of digital technology toys with different interfaces (Cubetto, Bee Bots, iPads) and how they could be used in an integrated Science, Technology, Engineering and Mathematics (iSTEM) learning project. Through researcher site visits, teacher observations of children's play, shared collegial reflection and teacher generated stories of children's learning, evidence emerged regarding the impact of digital technologies on young children's engagement with learning.

We will share examples of provocations, inquiry questioning and focus language used by the Educators as they integrated the digital technology toys into the learning environment. Emerging from these examples is evidence of the design features that make a digital technology toy developmentally appropriate for young children. Consideration is also given to the enablers and barriers faced by educators when engaging children with digital technology toys in an early childhood learning environment.