Pre-school teachers and parents’ use of technology during play-based practices: Engaging young children in learning science

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Aim of this study

• This study investigated how pre-school teachers and parents use technology during play-based practices to engage young children in learning science.

• In this presentation, the data from Stage 1 - teachers’ use of technology to engage young children in learning science is being reported.
“Are we going to space? For real?!”

March 26, 2018, ELC 4 Koala Room: On Wednesday, in our Creative Movement session with the drama teacher, we packed our bags and left for the space. But first, we needed to build our rocket ship.

T: What does the rocket need?

C: A roof

C: A fire

T: What shape is the roof?

C: Pointy

C: We need some windows

C: We need straight wings near the bottom

C: A platform. So we do not fall

C: We need space suits. So we can breathe

C: We need a screen to tell us what planet we are on

After the rocket was built, we boarded and landed on the Moon. When we disembarked, we were walking slowly. Why were we walking so slowly?

C: Because there is no gravity

Excerpts from Alice’s Journal (reprinted with permission)
• These notes provide an image of science teaching and learning in the early childhood classroom in which teachers and children are engaged in inquiries into scientific phenomena—Space and, more specifically, the planets and the solar system.

• These dialogues suggest the potential of 3- to 5-year-old children to engage in skills of inquiry.

• Explore basic phenomena that surrounds children’s world around ideas such as ‘how do we get to the Moon’ and ‘imagine how it would feel like to be at Moon’.
Background of the study

• Particularly, this study is important in the light of the recent Organisation for Economic and Collaboration Development (OECD, 2015) research report, which highlights how children’s higher-order thinking, above and beyond content learning, can be fostered by specific technology-supported pedagogic models.

• Speaking of the Australian early childhood context, the current Australian Science Curriculum Levels B-D (towards Foundation) (Department of Education and Training, DET, 2017) points towards teachers planning for children to intentionally participate in investigations, build children’s independence to observe, share/communicate what they discover and build children’s ICT capabilities.
The Australian early childhood context

• Preschool education is provided by both private and public sectors, which include long day care centres, sessional and community kindergartens, and early learning centres affiliated with private primary and secondary schools.

• The Early Years Learning Framework Australia (DEEWR, 2009) Learning and Development Outcome ‘Children are confident and involved learners’ guide the educators’ planning that reflects key science concepts.
So why to use technology while teaching science?

• To begin the process of more focused and deeper explorations involving children’s prediction, planning, collecting, and recording data

• Intentionally plan experiences where children demonstrate their understanding of objects and events through digital stories, images, pictures, alternative and augmentative communication in addition to simple statements (DeCoito & Richardson, 2017).

• By integrating technology during play, teachers together with children can create imaginary situations whereby the adult takes a more active role in children’s learning. Provide opportunities for students to engage with otherwise abstract concepts alongside developing problem solving and inquiry skills (Fleer, 2011).
Theoretical Framework

- The study draws upon Koehler and Mishra’s (2006) Technological, Pedagogical, and Content Knowledge (TPACK) framework that can assist teachers’ understanding of the complex connection between technology, pedagogy, and content for effective teaching of science concepts to preschool children.

- TPACK considers integration of technology can be useful tools for promoting learning and development when used intentionally by teachers in teaching and engaging young children in the learning of science concepts.
Research Context
This study’s context

• Three Early Learning Centres (ELC)/Kindergartens situated in culturally diverse communities in Melbourne, Australia.

• The ELCs were affiliated to independent International Baccalaureate (IB) primary-secondary schools.
Research Methodology
A multiple case study approach was employed.

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<tr>
<th>Research Question</th>
<th>Data collection</th>
<th>Participants</th>
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| How do pre-school teachers use technology during play-based practices to facilitate young children’s engagement in learning science? | a. Participant observation  
b. Document analysis – curriculum documents, artefacts, of both children and teachers’ planning/journals  
c. Semi-structured interviews (45 minutes each) | 7 kindergarten teachers (three from ELC 3 and four from ELC 4 classes) from 3 independent schools’ early learning centres |
Teacher Observation protocol

- The ‘Essential features of developing children’s science engagement’ teacher observational protocol was adapted from the Effective Early Education Experiences for Kids (E4Kids) study intentional teaching practices, which the study called as instructional support (Tayler et al., 2013).

- E4Kids is Australia’s largest five-year longitudinal study, conducted in 2010-2013, suggesting that early childhood professionals use intentional teaching strategies that are always purposeful, and may be pre-planned or spontaneous, to support achievement of well-considered and identified goals.
The protocol had five elements for recognising teachers’ pedagogical practices and integration of technology underpinning the TPACK framework.

- Teacher planning
- Scaffolding children’s prior scientific knowledge
- Children’s inquiry building skills
- Teacher-child and peer-peer interactions
- Children’s engagement in science learning
- Teacher Assessment/Review of children’s science understanding
<table>
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<th>Document analysis/Observations</th>
<th>Use of technology</th>
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<td>Teacher planned for hands-on activities through which the children can investigate, imagine and participate in inquiry-based experiences. Example: - Making a snow dome, sand and water play, - Exploring the naturalist environment, growing seeds, rainbow colors experiment, melting and freezing water, season changes, incursions such as visit from a doctor - Units of Inquiry of topics such as Change, Space, How the world works (Process of design and construction), - Materials (focus on STEM learning)</td>
<td>- Digital photography, teacher-led research about the units of inquiry, - Animated videos from BrainPop website, excursions to Scienceworks museum to watch animated and 3D movies on the space topic, - Use of projectors in the STEM corner of the classroom and to showcase children’s work, - Providing links to science webpages to parents via children's e-journals, sharing experimental ideas with parents through children’s e-journals</td>
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The wolphin looks different to a dolphin:

- The wolphin is bigger
- The wolphin has more teeth
- The wolphin is darker
- The wolphin's nose is shorter
“I know what the whole solar system is, it’s the whole planets.” - Note

Last term the children were curious about the Moon. We found a poster about the solar system and some of the children decided to paint their representation of the poster and the solar system. We had a discussion on Wednesday about the solar system and began to think about what we would like to know about planets and the Universe.

Vic Early Year Learning and Development Framework
Outcomes and Learning:

Children are confident and involved learners.
Children transfer and adapt what they have learnt from one context to another.
Earth orbits the sun. It takes 365 days. But you can’t feel it move.
Interview findings

Theme 1: Importance of integrating technology in pedagogical practices

• Although the teachers were concerned that 21st century technologies such as iPads could detract children from other types of play and social interactions, they were still apt for integrating technology in their classrooms.

  “There’s definitely great apps that you can use for different things. If you were showing – making a little movie we could use an app”.

• Teachers noted the benefits of using technology whilst capitalising on children’s prior scientific knowledge and/or misconceptions around everyday phenomena such as “Why is the Moon following us?, they are so curious about the natural world which incorporates science.

• Another key perspective highlighted by the teachers was the importance of collaborating with teachers from the primary and senior school campus.

  “And I’ve never used a little robot or anything like that, but I know the senior school teacher has shown a robot. I would speak to her because she’s an expert to get ideas”.
Theme 2: Need for ‘how’ to integrate technology

• While the teachers were keen to integrate technologically constructed science activities in their intentional teaching programs, there were issues around how to translate their intentional teaching practices into authentic inquiry-based experiences suitable for young children’s scientific conceptual understanding.

• Teachers were cautious because of the ways the school would promote integration of technology into their pedagogical practices.

  “So for us now that we are having the STEM room as part of our school will be fantastic, because that’s the focus. The school leaders will make time for it [integrating technology]. It will be amazing because the children love experiments”.

• To the extent that the teachers were in harmony to integrate technology in their pedagogical practices, they still flagged the need for the “how” to do things, not about “what” is required.
Theme 3: Use of technology to inform parents

- Teachers also invited parents via emails and children’s e-journals to engage them in science topics with their children at home.

  “If we have a link to what we’re doing, or we ask parents if they have a skill or an expertise that you could share with us in the classroom”.

  “One of the child’s mother was a doctor and she visited the ELC when the children were learning about the inquiry unit - Concept of change. “How do we change? How do our bodies change?”

- Teachers highlighted how this worked for them to build on children’s knowledge and reciprocally share it with the parents. We are encouraging parents to come in and the parent was a doctor and she did”. 
Contributions of this study

• Although teachers’ lack of TPACK was one of the reasons for their apprehension of integrating technology in their intentional teaching practices, this study takes a strengths-based approach in providing evidence of teachers’ intentional science teaching practices that attempts to provoke children’s inquiry skills.

• A technology infused pedagogical framework encompasses the five elements of teachers’ pedagogical practices and integration of technology in their intentional teaching.
Teacher’s Planning cycle in integration of technology - adapted from TPACK framework (Mishra & Koehler, 2006)
Implications and future directions

- Teachers planning and delivery of science content and choice of technology affordances needs to be looked into.

- The study poses implications for “how” teachers can infuse technology in their 21st century early years classrooms to intersect pedagogical practices and children’s science engagement and learning.

- The current research has identified the need for developing and implementing integrated pedagogies in EC classrooms, in using technology for teaching science.

- As such, the next phase of this research focuses on specifically designing and implementing the integrated pedagogical framework and co-researching with children and foregrounding their perspectives while engaging in learning technologically constructed science concepts.


“Knowledge rests not upon truth alone, but upon error also”

- Carl Jung

Questions and Comments

Thank you for your attention

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