TEACHING & LEARNING RESEARCH INITIATIVE
NĀU I WHATU TE KĀKAHU, HE TĀNIKO TAKU

PO Box 3237
Wellington, New Zealand
e-mail: tlri@nzcer.org.nz

Exploring student thinking, problem solving and collaboration in iPad-supported learning environments

Garry Falloon, School of Curriculum and Pedagogy, The University of Waikato in partnership with the staff and students of Leamington Primary School, Cambridge. **Project dates:** January 2015 – December 2016

Introduction

This project explored student thinking, problem solving and collaboration when using digital tablets (iPads) for a range of conventional curriculum-related purposes, and in project, problem and inquiry-based learning programmes. Three separate studies were completed in this project. They were

- investigating how students used their devices to collaborate on learning tasks in the classroom and beyond, which device features and functions they considered assisted in this process, and how these were used;
- exploring the nature of thinking skills students applied when using computational apps to solve learning problems embedded in mathematics curriculum; and
- analysing how students combined procedural and conceptual scaffolds within apps with practical 'hands on' work to learn basic science concepts.

Data were collected in junior and middle/upper primary innovative learning environments (ILEs) at Leamington Primary School in Cambridge, where small teams of teachers collaboratively planned, taught and assessed.

The Research Questions

The overall research questions guiding the study were

1. What thinking skills and collaborative strategies do junior and middle/senior primary students apply when using iPads and open/closed design apps for learning tasks?
2. What teaching, planning and management strategies support the effective use of iPads for learning purposes in BYOD, inquiry, values or thinking skill-based programmes at primary school level?

Separate research questions were generated for each of the three studies outlined above. These are included in the final report.

What we did

The three studies used similar methods to gather highly authentic data recording the strategies and practices of students as they used their devices within their normal daily classroom activities. A set of iPads supplied by the university were equipped with a display and audio capture app that recorded all student interaction with the apps and others they worked with, irrespective of their location in the classrooms. These data were downloaded and analysed against different coding frameworks using Studiocode video analysis software. Display data were supplemented with student interviews, focus groups and informal observations.

Key findings

1. Students seamlessly integrated device features and cloud-based services to support collaboration, information sharing and work organisation in the classroom, and after school hours. Using cloud-based services was seen as beneficial to work quality, as students could get timely feedback on their work from diverse audiences, and they could more effectively combine knowledge and skills when collaborating on tasks. Students identified a range of device technical and design features that supported in-class collaboration. These included display rotation, portability (compact device form factor), wide viewing angle, and multi user-input interface.
2. Students in both spaces easily transferred computational concepts learnt using one app to working with others. Tentative evidence existed that basic geometry concepts initially introduced using computational problem-based tasks, transferred into more conventional geometry learning. Computational tasks provided teachers with an excellent opportunity for their students to exercise general and higher order thinking, although thinking skill transfer from such tasks was not investigated. Establishing learning environments supportive of risk taking is important to encourage students to analyse and debug code. Students developed sophisticated strategies to make the solving of computational problems more manageable.
3. Students accessed and integrated a range of app scaffolds to support science procedural knowledge development, but conceptual scaffolds were generally ineffective. Textual complexity and unappealing format were identified as barriers to students' engaging with conceptual scaffolds. Teacher pedagogical content knowledge linked to workshop plenaries was critical to ensure students accurately learnt science concepts. Video procedural scaffolds (no audio) were effective for stimulating student discussion, debate and analysis, and provided a useful resource for reflecting upon and evaluating outcomes from practical tasks. The video scaffold encouraged students to consider the effects of variables on experiment results.
4. All studies highlighted the importance of robust, reliable and secure technical, wifi and internet access and infrastructure, to the success of technology-enhanced curriculum delivery.

Implications for practitioners

1. Careful and deliberate thought should be given to curriculum and learning task design to optimise the potential of mobile devices in the primary school. Teachers should consider the extent to which learning tasks will engage higher order thinking processes and involve students using devices to collaborate to develop and share original solutions for authentic learning problems.
2. A 'culture of collaboration' should be fostered in mobile device-supported learning environments. This should be reflected in learning task designs that encourage teamwork and the free exchange of ideas and knowledge. Teachers should model and where needed provide direct input to the development of students' collaborative skills and competencies.
3. Teachers should be mindful not to assume particular learning outcomes will be met by using apps. This particularly applies to concept development, where additional teaching, monitoring and assessment strategies should be used to check the conceptual 'learning value' apps are providing.
4. Device-supported learning environments encouraging risk taking and experimentation should be fostered to support students' thinking and problem solving competencies.
5. Strategic and appropriate teacher questioning and modelling of *learning as inquiry* are important pedagogical elements in building effective device-supported learning environments.
6. Teaching and scaffolding skills for accessing, managing and working with information of diverse types from different sources within authentic learning tasks, should be a focus from the early years of a child's education.

The research team (L to R)
Paula Hale, Garry Falloon, Tonia Fenemor, Leesa Mangino, Margaret Lelieveld

Contact details: garry.falloon@mq.edu.au