Chapter 22
The Inclusion of Technology in Mathematics: The Effects of Electronic Mobile Devices in Early Years Mathematics

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Abstract After finishing high school, I did not feel ready to go to university so I embarked on the adventure of a lifetime as a governess to four Indigenous children on a remote cattle station in Far North Queensland. This and further similar experiences led to my interest in enrolling in a teaching degree. One element of schools today that greatly fascinates me is the incorporation of technology in the classroom. I have observed the use of technology to enhance many learning areas but question the benefits of such technology. My questioning was the result of my experience with such technology outside the classroom, where it is often used for play and entertainment. However I came to see that used in a meaningful context, rich learning could occur, and technology could enhance learning outcomes, particularly in Early Childhood Mathematics, which was the area of my focus.

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> I quickly steal a glance towards the small group of prep students completing a mathematics rotation on iPads. Unlike the other groups, they are sitting quietly; happily and deeply engrossed in the task they have been set. What is it that sets the iPads apart from the other activities?

Introduction

I am a daughter, a sister, a wife and a mother. I am young, organised, cautious, yet carefree. I am a university student and a pre-service teacher. I am me. I am Emily.

My primary education was completed at my local public school which was filled with many challenges, opportunities and achievements before completing my secondary education at a private school in the neighbouring town. Whilst I thoroughly enjoyed school, I felt as though I was not ready to start university straight away. I needed a break, a chance to discover who I was, what I wanted in life and whom I

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wanted to become. Was I ready to move from the country to the heart of Melbourne to pursue a career in remedial massage? Would this be the move that shaped my life? Alternatively, would it become one that I would forever regret?

I yearned for a challenge, a change, an escape from my small hometown, so I embarked on the adventure of a lifetime—a governess to four Indigenous children on a remote cattle station in Far North Queensland. Whilst I lacked in experience, I made up for it in enthusiasm and passion. It was this decision that ultimately shaped the person I am today, and I could not be happier. It was the place where I met my husband, where I committed to furthering my education, and where I had my first child.

I spent an additional three years as a governess for families on remote cattle stations around Australia before spending a further three years working as a teacher's aide in both remote and rural schools. The experience of working in a variety of different school settings throughout Australia fuelled my passion for educating children.

One element of schools today that greatly fascinates me is the incorporation of technology in the classroom. In my personal schooling experience, we were fortunate enough to have a row of three or four computers at the back of the classroom predominantly used for typing up a final copy of a story or completing a project or a poster.

I have observed that in schools today, computers and their counterparts are utilised to enhance a subject, to allow a child to explore something in depth, to challenge them. Whilst I was and continue to be amazed at how far technology has come, I felt myself questioning the use of the devices within the classroom. In today's society, technology is constantly evolving and the ways in which they can be utilised are increasing. I feel as though this is impacting current and future teachers as they are compelled to incorporate technology within the classroom in order to assist students to effectively integrate within society. This paper seeks to explore the effects of electronic mobile devices in mathematics in enhancing early year primary school students' knowledge of number and place value.

Who Did I Think I Was?

I have always believed that my experience in education as a student was very modern and up to date with the latest technologies, and at the time, it was. It is amazing how significantly things can change in a year, two years or even three. When I enter the classroom now, I feel older, confused and not up to date with the latest technologies, their applications and effectiveness.

My personal experience and observations with electronic mobile devices such as iPads have led me to view them as a babysitter and a toy. iPads were filled with movies and episodes of television programmes to assist the passage of time on the long, arduous drives to town to prolong the inevitable question, "Are we there yet?" They were filled with games to maintain silence in waiting rooms or whilst out running errands and picking up parts for machinery. If a moment's silence was

required or you were too busy to entertain a child, the iPad would appear. A relative would constantly claim how smart their child was because they were able to write the alphabet before reaching school age. Although the child could trace the letters of the alphabet with their finger and be able to say them, did that knowledge transfer to the more traditional method of pen and paper? In this instance no, as they had always used their pointer finger to write the letters of the alphabet instead of a pencil.

I struggled to see how iPads could be effectively integrated into the classroom as an educational tool when they played such an opposing role outside the classroom environment. Was the knowledge acquired through the use of iPads transferrable? I was constantly hearing about how children in school and kindergarten all had iPads, but for what purpose? Were they being utilised as a baby sitter so teachers could work with other students? Alternatively, were they utilised as an educational tool?

My early observations of students utilising iPads during mathematics lessons led me towards the establishment of negative feelings towards their use but underneath that lay curiosity. I had heard many rave reviews about the use of iPads from teachers in classrooms in enhancing and supporting the acquisition of new knowledge and the understanding and the extension of current knowledge. Supporting teachers' opinions that the addition of electronic mobile devices is beneficial to students, Haßler et al. (2015) state that mobile devices can enhance, extend and enrich the concept of learning in a number of ways. Whilst the research may support this view; I still question whether students can enhance their knowledge of number and place value through the use of iPads.

From afar I observed students deeply engrossed in the application set by the teacher, I was amazed at how focused they were on the task. On closer inspection, I observed students guessing answers, tapping the screen wildly, flicking between different applications and repeatedly completing the same task. Was the teacher aware that the students were not completing the applications as intended? Why were students so eager to use the iPads yet appeared to struggle with the task? Was the task not appropriate for the individual student? Was it too challenging? Was it too easy? Was my observation a daily occurrence or was it a rare event which could be attributed to other factors?

Who Do I Think I Am?

As my time spent in teaching and learning environments increases, so too does my knowledge and understanding of effective teaching practices and tools in an ever-changing technology-dependent society. I feel as though the more I delve into the concept of the effects of electronic mobile devices in mathematics in enhancing early years primary school students' knowledge of number and place value, the more questions I have, and the more I have to learn. Observations and discussions with teachers of varying year levels have allowed me to view the iPad in a different light.

Observations lead me to see that utilised correctly in mathematics, electronic mobile devices such as iPads can enhance students' knowledge of number and place

value in the early years, but it is dependent upon the context and how they are incorporated into a lesson. As long as the iPad is utilised in a meaningful, purposeful and rich learning context, students will experience an increase in knowledge and understanding. Traxler and Wishart (2011, p.7) state that student knowledge is developed through "contingent mobile learning and teaching, situated learning, authentic learning, context-aware mobile learning, [and] personalised learning". iPads have the capacity to personalise student learning through the incorporation of applications which can be tailored to individuals needs. It is this capability that has allowed me to view them as an asset in the classroom environment as opposed to a hindrance.

Unlike traditional methods of pen and paper, iPads have the capacity to provide students with immediate feedback by correcting mistakes in real time (Lynch 2015). There are occasions when feedback is not valued as highly as it should be and can be challenging to provide to a large class of students working on a variety of different tasks, such as group rotations. By providing students with the immediate feedback, they can understand and retain content better (Kaur et al. 2017).

I was fortunate enough to observe students being provided with immediate feedback and delayed feedback. The individuals that were provided with immediate feedback were able to gain a deeper understanding of where they went wrong and were able to make suitable changes, thus increasing their knowledge and understanding of the concept. Students that were provided with delayed feedback appeared to struggle to understand the content, as it was not fresh in their minds due to having commenced another activity. Research and practical experience demonstrated to me the benefits of incorporating iPads into a daily routine, not only for students but also for teachers.

iPads are an effective alternative for students to utilise when revising previously taught concepts as opposed to the teaching of a new concept. iPads alone cannot be relied upon to teach a student. Instead they are best suited to support an individual's previous learning. A study conducted found that combining iPads with traditional teaching methods, thereby using them to supplement the main content, saw a vast improvement in students' conceptual understanding of numbers, the order of operations, expressions, and multiplication and division skills (Kaur et al. 2017).

The incorporation of iPads into the learning environment can be viewed as both a positive and negative experience, but through observation and lengthy discussions held with teachers, I have been able to solely view their inclusion as positive. When utilised in a meaningful context, iPads have the ability to supplement the main teaching content, personalise student learning and provide immediate feedback. I have found that they do have the capability of allowing the knowledge acquired through their use to become transferable.

Of This Much I Am Sure

Goodwin (2012) claims that when an electronic mobile device is deployed and embedded in an authentic and rich learning experience, the benefits are abundant.

Initially, I was sceptical given my previous experience, but after being given the opportunity to view the use of iPads in a different context and after conducting many informal discussions with teaching staff I was able to see how the Goodwin had come to make that bold statement.

In order to gain a thorough understanding, I held many informal discussions with teaching staff to gain an insight into their perspectives and experiences based upon the implementation of iPads into learning environments, specifically mathematics. Originally, I was unsure that iPads even held a place within the educational environment, mainly due to my previous experience of how they were utilised outside the school environment. The teachers surprised me with their positivity approach to the use of iPads in education, particularly mathematics, but were all careful to note that the benefits were only apparent when working in an appropriate and meaningful context. The iPad was viewed as a valuable resource especially for differentiation of the learning, for revision of prior content and for keeping students engaged.

The teachers all noted that responses from children when incorporating iPads in a lesson, particularly in the early years, were positive, as it was a great alternative to paper and pencil, but they were adamant that they not be to be used to teach the content alone, nor to be the only tool used to revise learning. I held a similar view that children were always eager to utilise an iPad, but I found it interesting and insightful how all the teachers were quick to point out that it is a tool to support learning as opposed to teaching content.

I previously questioned whether your gender impacted your experience with technology, but after discussions held with teachers, I was able to confidently conclude that there is no observable difference in the use of technology by either gender, male or female.

Of this much I am sure, positive effects from the implementation of electronic mobile devices in mathematics in enhancing early years primary school students' knowledge of number and place value can occur, and the knowledge gained is transferable but it is dependent upon a variety of different factors, comprising context, method of incorporation and purpose (i.e. supporting previously taught concepts).

Conclusion

I never anticipated writing a report on the effects of electronic mobile devices, such as iPads in mathematics in enhancing students' knowledge, as I had just come to accept their place in the classroom without ever questioning their purpose and the potential benefits to be gained. Without the opportunity to question and reflect on their purpose and existence, I do not believe my understanding would be as deep as it is today. I would have continued to question their purpose and potential. I experienced a complete change of opinion through this research paper and am incredibly grateful for the opportunity, as I believe it will assist me in becoming a better teacher as I will be more aware of how technology can be best incorporated into the classroom to benefit students. I can confidently conclude that students can utilise iPads to

effectively enhance their knowledge of number and place value with the knowledge gained also being transferrable.

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