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Abstract

A New Zealand comparative case study investigated the impact of technological device use in literacy, over a three month period, for Year (Grade) 4-6 and Year 7-8 students. In school A (Year 4-6 students) data were gathered from two pairs of control matched classes, one of each pair of classes using technological devices; in school B (Year 7-8 students) comparisons were made pre and post technology use. In both schools, pre and post- standardised achievement data were analysed, along with classroom observations, student and teacher interview data. Whilst significant progress was made in student achievement, when compared with national average point score shifts (Poskitt, in press), of particular interest in this article are young adolescent students' views about effective pedagogy and technology use. For adolescents, availability of devices made learning more: fun, time efficient, accessible outside of school hours; and enhanced their research and presentation of learning. At times, friends and classmates helped by sharing information and new ideas, but frequent talking and distractions hindered learning. However, the pedagogical actions of teachers (particularly explicit, focused teaching of literacy and technology knowledge strategies) and provision of choices, varied and active learning opportunities were perceived to make the greatest difference to student learning.

Keywords: young adolescents, technological devices, pedagogical strategies, student voice, improved learning

Introduction

Schools are increasingly adopting the use of digital technologies in the belief that their use enhances the appeal, relevance and effectiveness of learning inside and outside

school for young adolescents. Yet principals sometimes question the efficacy, partly through fear of student access to potentially undesirable information or associated distractions, additional resources required for professional learning and purchase of equipment, and perceptions of tenuous links between technological use and student achievement gains. Published research reveals mixed views on the impact of digital technology use on student learning (e.g. Cheung & Slavin, 2013; Livingstone, 2012); with variance attributed to factors such as research design, socio-economic background, student age and gender. While there is research on teacher technological pedagogical and content knowledge (e.g. Kulik, 2003), the interaction between teachers' pedagogical practice and young adolescent student knowledge, attitudes and classroom learning activities is less well known. This paper examines these interactions and impact on student learning in two New Zealand case study schools.

Literature review

Adolescence

Adolescence is characterised by significant physical changes as the human body matures from child to adult form. Most importantly for schooling are the myriad brain changes that occur during puberty (Nagal, 2010). Effectively, the brain undergoes transformation. Localised synaptic pruning occurs of less frequently used pathways, whilst other synaptic pathways are strengthened through continued myelination of nerve fibres enabling greater connectivity (hence more abstract and conceptual thought) to evolve (Steinberg, 2006). Indeed, Steinberg (2006, p.70) argues, "at the core of adolescent development is the attainment of a more fully conscious, self-directed and self-regulating mind." However, in the early stages of adolescence, rapid development of the limbic (emotional centre) results in heightened emotional arousal and impulsive behaviours, increasing pleasure and emotional rewards from interactions with peers, higher levels of risk-taking and minimal capacity to evaluate risk (Steinberg, 2006) or, at times, to focus on

cognitive matters. Not surprisingly students experience declining interest in school and seek more stimulating experiences (Poskitt, 2015). They have an increasing need for connection to the world outside of school and family (Langenkamp, 2010; Lansford, Killeya-Jones, Miller & Costanzo, 2009); a need for growing competence, confidence, and a positive self-concept (Preckel, Niepel, Schneider & Bruner, 2013) as their identity evolves.

Student engagement in learning

Recognition of students' divaricate interests, alongside the importance of attainment of educational outcomes to prepare students for effective citizenship and productive employment in society, has resulted in extensive research in the student engagement literature. Key factors to retaining student interest in school learning include establishing and enriching young people's sense of belonging and connectedness to their school (teachers and peers), fostering the intrinsic value of learning, developing a sense of agency and self-efficacy, and realizing that engagement is a variable state influenced by internal and external factors, some of which the teacher and student can modify (Gibbs & Poskitt, 2010). Realizing the notion of engagement is comprised of three components: behavioural, emotional and cognitive elements, schools (and students) have a role in enhancing all three. One means of more accurately targeting time and resources to make a difference for student engagement in learning is investigating adolescents' perceptions of educational experiences.

Student voice

Seeking the views of young people through 'student voice' research is based on beliefs about the rights of young people to have a say, to be listened to, empowered, and for their contribution to make a difference (Cook-Sather, 2014). Not only does such student voice yield more authentic research results through insights into which educational policies and practices truly serve student needs, it has the potential to empower students to identify issues and possible solutions (Mansfield, 2014). As Mansfield (2014, p. 399) argues:

> Seeking student voice to improve educational practice is supported by literature in student development, motivation theory, self-determination theory, and constructivist learning theory because these fields recognize the importance of active student engagement in and feedback to the educational process (Sands et al., 2007). At the most basic level, student voice efforts result in development of civic habits essential to democracy, while engaging students at higher levels results in curricular improvements and strengthens teacher-student relationships (Fielding, 2001, 2004; Mitra, 2006, 2008; Mitra & Gross, 2009; Sands et al., 2007).

Attracting student attentional engagement

Student voice research is an important means of understanding what is happening in schools from the viewpoint of the 'recipients' of education and, more critically, what schools can do to improve educational experiences and outcomes for students, particularly those who are under-represented or marginalised (Cook-Sather, 2014; Mansfield, 2014). It is important to realise student focus and engagement varies according to levels of interest, perceptions of competence and influence of friends. What attracts student attention, referred to as 'attentional engagement', has a number of features including, "equipment with various tools/objects/technologies (e.g. computers), tasks (e.g. labs/assignments), activities or disciplines (e.g. dance or math), people (e.g. peers, teachers, coaches) and places/social settings (e.g. school or community agency)" according to Lawson and Lawson (2013, p.444). The level and duration of attentional engagement can be influenced by the use of particular technologies and also the accompanying pedagogical approaches (Dockter, Haug & Lewis, 2010), and the balance of peer and teacher interaction alongside sustained time using devices.

Influence of technological device use

A review of literature related to the value of technological device use in schools reveals widespread agreement about the motivational impact on students, increased interest in

learning tasks, improved student attitudes towards learning, efficiencies in teacher instructional time, and heightened feelings of connectedness to the world beyond school and the workforce (Chen, Chaing & Lin, 2013; Cheung & Slavin, 2012; Ertmer & Ottenbreit-Leftwich, 2010; Kulik & Kulik, 1991; Wright, 2010). Apart from some learning and assessment tasks that can only be completed with the use of technology, there are mixed views in the research literature about the effects of technological device use on student achievement (Cheung & Slavin, 2013; de Koster, Kuipert & Volman, 2012; Harris, Mishra & Koehler, 2009; Livingstone, 2012; Mangen, Walgermo & Bronnick, 2013; Slavin, Lake, Davis & Madden, 2011). Some of the variable outcomes are attributed to research design, such as size of study, a lack of comparative data, inadequate measures of shifts, or insufficient details about the context and educational interventions (Cheung & Slavin, 2013; Kulik, 2003). Nevertheless, meta-analysis studies suggest several factors influence positive gains for particular students using technological devices: students from lower socio-economic family backgrounds, lower to middle ability, increasing age of student and gender - with boys typically showing greater gains (Cheung & Slavin, 2013; Freddano & Paolo, 2012). Another influencing factor is pedagogical practice.

Pedagogical practice

The approach taken to integration of technological devices into classroom pedagogy varies according to teacher beliefs about curriculum, learning, teaching and their confidence with technology (de Koster, Kuipert and Volman, 2011; Voogt, 2010). Building on the pedagogical content knowledge concepts of Shulman (1986, 1987), researchers have integrated technological knowledge (TK) into a technological pedagogical content knowledge (TPACK) framework (Harris, Mishra, & Koehler, 2009; Koehler & Mishra, 2008; Mishra & Koehler, 2006; Pierson, 2001). The TPACK framework argues for the connection and interaction of:

a) technological content knowledge (TCK –understanding how technology and content can interact positively and negatively for learning; realising some tools are better suited to certain subject areas than others) and
b) technological pedagogical knowledge (TPK – teacher knowledge of a range of technological tools, their pedagogical affordances, limitations and applicability to types of pedagogical approaches) and
c) technological pedagogical content knowledge (TPACK – understanding the complex interplay between content, pedagogy and technology and developing capacity to "interweave these interdependent factors" (Harris et al., 2009, p.396-397).

Harris et al., (2009) argue the dynamic and evolving nature of technological knowledge, requiring teachers to skilfully apply their knowledge and skills in accordance with students' emerging learning needs and preferences. These findings are supported by the work of Abdul Razak and Connolly (2013) who found student preference for games based or traditional learning approaches was influenced by teachers' pedagogical style. Optimal student learning appears to need alignment between the teachers' technological pedagogical content knowledge, learning content and learning activities; and responsiveness to student experience with, and attitudes towards, technological devices.

In classes with a teacher-directed style, technology is largely used for independent work by students to practise or reinforce learning, whereas in more innovative classes ICT use is often associated with open-ended, exploratory activities with student input. However, the latter encounter more technical and organisational challenges with equipment and software, as well as incomplete work due to disruptions to learning time. In order to achieve deeper learning, Hutchison, Beschorner and Schmidt-Crawford (2012), recommend teachers give students explicit instructions on basic features of applications, opportunities to explore

and experiment with tools and time to teach one another. In the early stages of implementation, teachers and students are likely to encounter difficulties such as manipulating images, saving and sharing work, becoming familiar with specific functionalities and disruptions to learning time solving technology issues (Hutchison, Beschorner and Schmidt-Crawford, 2012).

Livingstone (2012) contends there is minimal evidence of the impact of ICT on learning, partly due to the lack of comparative studies. Studies using matched control designs with qualitative elements to provide depth and insight are deemed by Cheung and Slavin (2012, 2013) to be necessary. This article seeks to contribute to the literature regarding comparative data, contextual information about classroom interventions and student perspectives of effective pedagogy and technology use.

Research Design

Sample

The comparative case studies took place over two 12 week periods; school A in term two (April to July) of the four term school year; and school B in term three (July to September). School A participants (*n*=100 students; four teachers) were Year (Grade) 4, 5 and 6 (aged 8 to 11 years old) in one urban primary school in New Zealand; and in school B (90 students, four teachers) in Year 7 and 8 (aged 11-13 years old). The research sample represented the school population, comprising predominantly European, followed by Māori and small proportions of other nationalities (such as Indian/Pakistan/Sri Lankan; South East Asian; Chinese and Pacifica). Families of children attending school A tended to represent middle to higher socio-economic status (SES) while school B were middle to lower SES. Of the eight participating teachers, five were female, three male, and all identified as European New Zealanders. In school A two teachers volunteered to experiment with technological devices ('technology' teachers), and two teachers agreed to defer use in literacy (reading)

lessons until the subsequent school term ('non-technology' teachers); in school B the four teachers integrated technology into their literacy programmes. Although school A technology classes used common devices and software such as laptops, notebooks, iPods, iPads, interactive whiteboards, software such as Kid Pix, Lexia, MyPortfolio, digital cameras and searches of the school intranet, internet, and Youtube; school B mostly used iPads, searched the internet and used Google Doc platforms.

Procedure

All measures were administered in the students' respective classrooms or nearby withdrawal room (for student group interviews) and carried out by the author, except the pre-test and post-test in reading comprehension which was administered by classroom teachers but analysed by the author. University ethics committee approval was granted and ethical principles were applied: informed active consent, with the right to decline to participate or to withdraw at any time, assurances of confidentiality, truthfulness and avoidance of harm. All participating students undertook the pre-test and post-test, and group student interviews. Participating teachers were interviewed at the beginning and end of the study, and classroom observations were undertaken beginning, and end of the study period by the author.

Data were recorded only for the consenting students, with a particular focus on the nature of the reading activities engaged in whilst being instructed by the teacher and in subsequent independent learning time; and teacher to student, student to student interactions. Details of the standardised reading-comprehension test composition, student achievement results (e-asTTle, normed for New Zealand students) and teacher interviews can be found in (author, in press).

Results

In essence, all classes made significant progress, with up to four times the national expected point score difference. There was minimal difference between the Year 4

'technology' and 'non-technology' student achievement in reading comprehension, but a positive difference for the older students using technological devices. Examination of observational and student interview data revealed some intriguing explanations.

School A (students Years 4-6)

Anxieties and frustrations about technical issues with technology use

Observational and student interview data with the Year 4 students revealed initial anxieties in using technology (e.g. worries about effects on eyesight or brain), concerns about distraction of games from 'real learning' and a perception that 'real reading' only occurred with print copy materials. Moreover, some of the Year 4 students struggled, particularly with iPads, to scroll pages, flick from one screen to another, change fonts or other document appearance options. These younger students lacked knowledge and skill in moving from one website to another, basic searching tasks, saving and retrieving files. Similar frustrations and anxieties were encountered in a study by Beavis, Muspratt and Thompson (2015). However, these issues were somewhat mitigated in the older students' classes due to greater familiarity with the tools outside of school, and in school B, an Apple consultant had spent time with teachers and students in the first days of using iPads, tutoring them in the 'technical' basics of scrolling, saving, retrieving files and essentials about frequently used apps.

Realizing the benefits of technology use

However, after a school term (three months) in the study, school A 'technology' research students' interviews (Years 4-6) revealed their appreciation for:

- Additional features of reading electronically ('click' for: definitions, pronunciation, further information or visual images)
- Ready access to researching information
- Increased variety of reading 'follow up' activities (e.g. applying comprehension strategies while viewing moving images)

- Ease of regulating their own learning (e.g. deepening or extending understanding by further searching)
- Improved presentation (colourful and varied fonts, not worrying about spelling or neatness)
- Realising transferability of reading skills from print to electronic forms
- Ease of sharing learning (teacher, students, parents)

Students were considerably more positive about the use and value of technology at the end of the research study although they noted difficulties with re-reading and locating information in an electronic document compared with print forms.

Influence of teacher pedagogical practice

Analysis of classroom observations of teachers' reading instruction with small groups revealed interesting patterns. Both Year 4 teachers began the session with a clear focus for their small group session. Teacher attention and continual reference to comprehension strategies ensured students maintained focus on the important features for reading, especially when teachers asked them to identify specific information, to evaluate and make judgments from their reading. These behaviours were influential in the significant progress the classes made in reading comprehension.

However, Table 1 displays subtle differences in pedagogical practice. Teacher 1 (non-technology) spent more time extending students' vocabulary, checking for student understanding, and encouraging students to make inferences from the text. Teacher 2 (technology), directed students to identify specific information, predict and make judgments, but was diverted with 'technical instructions' (e.g. "use the search bar", "open the website"). Yet this teacher optimised opportunities while searching websites to develop students' critical thinking and evaluative skills about the trustworthiness of information. Nevertheless, such diversion of teacher instructional time may provide some explanation as to why the Year 4

students' 'technology' and 'non-technology' achievement results were equivocal (rather than higher for 'technology' students).

Observations of student activity during independent learning time away from the teachers revealed well organised 'follow-up' activities. Students' time was spent on tasks directly related to reading comprehension; regardless of technology use (e.g. summarising a story, predicting endings, evaluating options). However, technology use (once technically capable) freed students from anxiety about neatness or other related presentation difficulties and enabled them to use more of their lesson time applying reading comprehension strategies or extending research skills.

Table 1. Observational extracts from Year 4 technology and non-technology teacher instructional time

Non-technology class (Teacher 1)	Technology class (Teacher 2)
During an instructional session with a small group reading a shared text, the following discussion occurred between the teacher (T) and students (S): T: There are some dangers that divers face, can you find out some more dangers from the text please (1) S: The divers must come up slowly. T: Why must they come up slowly?(2) Students did not know. Teacher provided a brief explanation using a comparison with them swimming in a pool. T: Finds a word then points "What does this word mean?" (3) S:Discovery T: What was the main idea you found in the text? (4) (listened to all group members' ideas) T: Who do you think should keep the treasure? (5) Read to page 18 and tell me what you think… Key: Notice the teacher's attention on: 1. Identifying specific information 2. Checking for understanding 3. Extending vocabulary 4. Inferring from the text	During an instructional session with a small group reading a shared text, the following discussion occurred between the teacher (T) and students (S): T: Today we are reading on computers. *Open yours up and search the KiwiKids news site. How might you find that?* (1) S: Use the search bar T: Smart strategy, *the search bar helps you find things on the internet* (1). First make a prediction (2), then use the website to describe liger (3). Group did not know. S: Maybe an animal, something like a tiger? T: *Open up the website (1)… Remember you can click on highlighted words to clarify the meaning, like a dictionary.* What have you found out (3)? T: No, we're looking for something else. S: It is a half lion, half tiger. T: *Do you think it is a reliable website* (4)? S: Yes T: How do you know? *What signs do you look for to know it is reliable?*

5. Evaluating and making judgments NB: (x) = type of teacher action e.g. (1) refers to statements/questions inviting students to identify specific information	S1: Read a couple of sites to see if the information is similar? S2: Look for the http? T: Yes, what about the content? S3: The language used? S4: Read to see if the author is an authority, like a scientist for information on animals? T: It is a reliable website so it is probably true. Search using another term, half tiger and half lion (1, 3) and read that article… T: When was that article written? (3) … If it was only 40 days ago would we find that information in a book? What comprehension strategies were you using? S: Visualising what I thought it would look like before viewing the picture. S: Predicting what it might look like T: If I wanted to check if the website was reliable I could go to Geographic for kids…(4) Notice the teacher's attention on: 1. *Technical instruction* 2. Predicting 3. Identifying specific information 4. Evaluating and making judgments

Differences in teacher instructional practice were even more intriguing with the Year 5/6 students (Table 2). Notice Teacher 3 (non-technology) multiple purposes for the session (thinking, questioning, understanding what good readers do), the proportion of teacher talk to students, and the length of teacher utterances. In contrast Teacher 4 (technology), while not stating the purpose at the outset, was focused throughout the session on character. Students were asked to identify specific information and to infer. Only one statement was of a 'technical' nature (e.g. instructing students how to open an electronic folder), other instructions were linked to comprehension strategies (what features helped you come to that understanding?) and directing student attention to specific details (e.g. sound) to deepen their

understanding. These older students needed less frequent explicit 'technical' instruction on device use. Most noticeable in this extract was prompting of active student learning by the teacher's succinct, targeted questions and instructions.

Table 2. Observational extracts from Year 5/6 technology and non-technology teacher instructional time

Non-technology class (Teacher 3)	Technology class (Teacher 4)
Addressing a 'book' reading group on the mat, T: What is our purpose? Because you have read most of the book do you think you now know who the man is behind the mask? Why? Why did I ask why? What did I get you to do? S: Help us think T: What sort of thinking am I getting you to do? I want you to justify – give a reason for your answer. If you think it is the son in the mask, who is the other person? S: I think it is the half-brother. T: Can you explain or justify your answer? S: inaudible. T: Remember we ask questions to build our understanding. How do we know what type of question it is? How do questions build our understanding? How does questioning help your understanding? S: You do more reading because you go back to find the answer. T: Okay, so it helps you read more… Good readers ask questions during and after they read. Sometimes the answers are in the text, sometimes you have to draw on your prior knowledge to help you understand or read other books to help you understand. What other books might you need to read to help you understand difficult words? S: Dictionary T: Indeed. Now think about some questions about the text. Look at the picture, title, text – all of these things help us. Readers work out puzzles so look at all these pieces to work it out… Note the teacher's:	A group of children, each with a laptop, are with the teacher for reading instruction: T: Today we will use the comprehension skills of visualising and inferring. Open your folder to your character reference please (instructed two students to click on a folder, then room 1 folder, then their own folder) (3) T: Yesterday we worked on inference – what helped you understand the character? (1)… Today we will use visual text for inference and looking for clues to add to our character inference (2). View this part of the clip to think about how the sound and music help develop your understanding (2) S: Scary music makes you think it's a scary character S: The music starts quiet and then gets louder and faster S: Yeah and the lighting gets darker to make you more scared T: So the music helps you infer it is a scary character (2, 3)… Jot down those ideas… T: Now view the next part of the clip… what are you inferring about the character now? S: shy, quiet T: What features helped you come to that understanding? (2, 3) S: volume, background lighting… Note the teacher's attention on: 1. Inference 2. Identifying specific information 3. Technical instruction

1. Multiple purposes (thinking, questioning, understanding what good readers do) 2. Proportion of talk to students' 3. Length of utterances	

School B (students Years 7/8)

Enhancing 'technical' use of iPads

Accompanying the introduction of iPads (one device per student in the four classes), was tutoring from an external (Apple) consultant who demonstrated to the students technical aspects of using the devices (e.g. opening/closing, saving/retrieving files; scrolling, main features of key applications). Spending time the first day with such tuition resulted in more confident users and minimised subsequent disruptions to learning due to basic 'technical' matters. Notwithstanding this, minor technical issues still arose, such as 'freezing' of devices, periodic loss of work, and neglecting to recharge batteries.

Enthusiastic response to iPads and learning

Student interviews revealed high levels of enthusiasm for use of iPads in their literacy learning. Table 3 displays student perceptions related to four themes: what helped their learning, what distracted them from learning, how the teacher enhanced their learning and what they would like changed.

Table 3: Student (Year 7/8) views about the impact of iPad use on learning

Positive aspects helping learning:	**Distractions from learning:**
• Very high support for 1:1 iPads • Ease of researching, recording, presenting ideas (c.f. pen/paper) • Time efficiencies (not waiting, faster(• Value of optional workshops • Continuity of learning outside school	• Frequent interruptions and noise of other students • Student behaviour • Minor covert misuse of iPads (e.g. photo booth)
What teachers do to help learning:	**Changes students would like:**
• Workshops (specific skills/topics) • Choices (what, when, where, who) • Clear instructions, willing to re-	• More workshops (teacher instruction) • Fairer distribution of teacher time and attention

explain • Teaching strategies/knowledge • Modelling, guidance, brainstorming, questioning to stimulate thinking • Feedback	• More frequent/timely individual help • More varied (active, creative) activities • Reduce classroom noise levels • Reduce interruptions by other students

These Year 7 and 8 students (aged 11-13 years) were excited about iPad availability and valued the ease, speed and time efficiencies of iPad use. Some students continued school learning at home by accessing Google Docs remotely; something they had not previously done. Nevertheless, the majority of factors helping their learning were more related to pedagogy (e.g. clear instructions, questioning) than the use of technology. Earlier in the school year, students had been introduced to an independent learning programme in literacy and maths. They were given required 'must do' tasks and could select amongst a range of 'may do' tasks to complete within the week, at a time and order students chose. Teachers offered several workshop (instructional sessions) choices for students to select at least one, or up to several to attend. Students commented on the value of the workshops, choices, instructions, questioning and feedback to aid their learning (refer to Table 3).

Apart from periodic inappropriate use of iPads (such as distorting personal photos through Photo Booth, or searching information unrelated to the current learning topic), the main distractions from learning were other student behaviours (talking, showing irrelevant website information, noise levels) and wanting more individual help from the teacher.

Discussion

Technological device use

Student interview data across the Year 4-8 groups revealed the value of technological device use in raising student enjoyment and motivational levels, greater efficiencies in learning time (ease of research, and reduced waiting time for the teacher and other students), more attention on deeper learning (less time wasted on presentation such as neatness and

searching dictionaries for correct spelling), and greater variety of active learning tasks. Student voice research in this regard is consistent with international literature on the appeal of technological devices to increase student interest and motivational levels (Cheung & Slavin, 2013; Wright, 2010).

Nevertheless, incorporation of technological devices did not result in utopia. Extracts of teacher instructional time revealed diversion of teacher and student attention to 'technical' aspects of using the devices at the expense of 'focused reading' learning time. Moreover, some frustrations were expressed about devices occasionally malfunctioning, or temptations (games, alternative websites) diverting student attention from the task at hand. A similar trend was found by de Koster et al., (2011) and Hutchison et al., (2012).

Pedagogical considerations

Student interview data revealed, with respect to student learning and engagement, greater influence of pedagogical approaches over use of technological devices. Targeted teacher questioning and clear instruction focused student attention on central features of their learning (comprehension strategies), as well as verbal discussion and associated 'follow-up' activities that elicited active learning from the students. Observations of subtle variations in quality learning time during teacher instruction and independent activity shed further insights into how learning with technology was affected by pedagogical practice.

Learning preferences for adolescents

As discussed in the introduction, adolescents are typically seeking active (cognitive and physical) learning, choices in their learning (how, what, when, who with), optimal levels of learning tasks as well as friendly teachers who explain things clearly and precisely (Poskitt, 2015). Furthermore, factors like variety, novelty, self-regulation influence student engagement in learning (Gibbs & Poskitt, 2010); classroom factors evident in the Year 6 (teacher 4) class and the Year 7/8 independent learning programme.

Cheung and Slavin (2012) argued *integrated* technological innovations showed more promising evidence of positive student achievement gains than computer-assisted programmes alone. Ultimately, "what matters is how technology integrates with non-technology components of reading instruction" (Cheung & Slavin, 2012, p.22). The 'how' has been revealed in this case study through extracts of teacher instructional strategies, follow-up learning activities and student responses to these approaches.

Conclusion

This study provides evidence of the importance of clear teacher instruction, modelling and scaffolding (of both the content – reading comprehension – and the technological tool), focusing student attention on details through specific questioning and targeted (teacher directed and independent) tasks to actively apply comprehension (and technology) skills, alignment of the task to match the knowledge and skills being developed and to optimise lesson time on purposeful learning. The latter required teachers to not only deliberately plan their instructional and student independent learning time, but to listen to student views and to be responsive to their emerging learning needs (such as the transfer of comprehension strategies from print to electronic medium, and the desire for more individualised teacher instructional time).

Quality of instruction, appropriate levels of instruction, incentive and time were identified by Slavin (1994, 2009) as four factors of effective teaching. To that list, this current study might add listening to student voice. Beavis, Muspratt and Thompson (2015) highlight the importance of listening to student voices and experiences to integrate technological devices into the learning experiences of students, appreciating the need for a variety of approaches to suit the personalised needs of students. Finding time to listen and to adapt learning programmes in accordance with adolescent preferences for learning requires teachers with an open-minded approach to education, willingness to experiment and learn with

students; what Svihla, Reeve, Sagy and Kali (2015) refer to as *design* technology integration, enabling incorporation of technology into curriculum for real-world use.

This study revealed how technical frustrations detracted from central learning, particularly with younger adolescents (Year 4 'technology' students); yet with greater competence in Year 5/6 technical disruptions were minimal, and featured even less with the Year 7/8 students where time had been invested in 'technical instruction' with the introduction of iPads. The research was limited to only two schools, each for the duration of one school term, in one aspect of literacy (reading comprehension). Results may differ in other schools and time periods. More research is needed before generalisations can be made in relation to teacher instructional practices, student voice and particular technological devices, and in different aspects of literacy (such as student writing) or other curriculum areas.

Nevertheless, the study suggests extensive software or application use is not necessary; rather a responsiveness to and input from the learner, resulting in a dynamic pedagogical approach, or as Svihla et al. (2015) argue - design, where technology device use is incorporated organically, enabling teachers and students to extend variety, choices and application of learning. Teachers need to be open to seeking and incorporating student input into technological learning programmes. In the words of a Year 8 student:

> *I enjoy the freedom and searching on my iPad but I love it most when the teacher cruises the classroom and pauses with me – her questions about my learning and explanations help me do so much more.*

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