Creating content: Building literacy skills in year 1 students using open format apps

Garry Falloon
Associate Professor
The Faculty of Education
University of Waikato
Hamilton
New Zealand

Email: falloong@waikato.ac.nz
Tel: 00 64 7 838 4466 x 6553

Abstract

Since its release in 2010, Apple's iPad has received much attention by media and commentators who claim its portability, usability, connectivity and relative affordability make it an ideal solution for schools wishing to progress their use of digital technologies in their curriculum. Indeed, many schools have responded to this via initiatives ranging from provisioning a few devices in classrooms or amongst staff, through to bring your own device (BYOD) programmes, or insisting students purchase a device in much the same way as books on a stationery list. However, due to their recent advent on the education scene, research is only at the emerging stage of exploring how the devices and their vast array of apps can be effectively used to support student learning.

The study which is the subject of this report focuses on findings from an initial investigation of year 1 students' interaction with apps selected by their teacher to build basic oral and written literacy skills. It uses a unique "observeware" app to capture data which illustrates strategies students applied, and important factors that affected

the learning value generated from use of the apps, as they created content linked to their literacy programme. Findings indicate that when carefully selected and purposely linked to learning goals, open-format apps can create flexible and engaging environments for students working together to exercise learnt knowledge and skills. However, they also point to the importance of student knowledge and the very active teacher role in supporting and scaffolding this process.

Keywords: iPad, literacy, content, create, collaboration, engagement, knowledge

Introduction

Over the past year or two, many schools in New Zealand and internationally have engaged in what at times appears as a frenzied effort to populate their classrooms with hand-held technologies – probably the most popular of these being Apple's iPad – responding to the "educational game changing" (Martin-Brown, 2010) hype and rhetoric surrounding the device's launch in 2010. These efforts have taken a number of different forms. They range from schools buying a few devices often distributing them to staff for administrative purposes, to one or two devices in some or all classrooms, through to the most widely publicised approach of bring your own device or BYOD. While a growing number of iPad studies are being published, many of these focus on use in relatively specialised contexts such as special education (Billings & Mathison, 2012; McClanahan, Williams, Kennedy & Tate, 2012), explore administrative efficiencies and cost saving benefits (Foote, 2012; Hall & Smith, 2011) or detail effective infrastructure and management systems for school and classroom use (Crichton, Pegler & White, 2012; Henderson & Yeow, 2012). A few others have documented perceptions of enhanced student motivation and engagement and speculated on the effect of this on learning, although these have largely been based on observation, self-report or interview data (Manuguerra & Petocz, 2011; Saine, 2012). Very few, if any, studies have attempted to probe more deeply into student interaction in an effort to unravel more detailed information on how students work and interact with the devices and their apps, particularly in classroom scenarios where relatively independent use is encouraged. This article reports early findings from a study of new entrant students using iPads and content-creation apps to practice and build foundation oral and written language skills. It uses a specifically developed observeware app to

record student pairs working independently on two popular apps, Popplet and Puppet Pals HD, in an attempt to reveal evidence of how apps of this design are independently used by young children for teacher-set language development tasks.

iPads in schools

Due to their recent advent, the literature on mobile hand-held devices such as the iPad is still developing. However, some studies have been published detailing the effects of different uses across all levels of education. A recent study by Henderson and Yeow (2012) explored the integration of 48 iPads in a large Auckland primary school. The devices were organised in pods of five or six, and were generally used at the senior school (9–12 years) level. The qualitative study examined organisational and management considerations, how the devices were used in the classroom, and how they supported student collaboration and learning engagement. Their results indicated that besides provisioning, to be useful the devices needed to be supported by robust internal school wifi infrastructure, easily managed systems for booking, allocation and charging, and an ongoing commitment to the cost of data and app purchase. They also found device mobility to be a major affordance, with teachers describing learning as becoming "more accessible and productive… as [iPads] allowed information to be easily searched and accessed quicker at any given location in the classroom" (Henderson & Yeow, 2012, p. 83). This attribute was also noted to support learning collaboration, as teachers found the easy, instant set-up, small form factor and light device weight more readily supported sharing and using in pairs or small groups. However, they found firm ground rules needed to be established to avoid individuals dominating "display time" when devices were used in larger groups. Their study also identified enhanced levels of learner engagement with tasks, commenting that the students "felt empowered by their work, creating and sharing richer content with their peers, parents and teachers confidently through a digital medium" (p. 86). However, little data were presented to support these claims. Instead, engagement appeared to be equated to students spending more time on their work, and producing more attractive presentations (p. 86).

Another study by McClanahan, Williams, Kennedy and Tate (2012) examined use of the iPad to support the reading development of an ADHD student. After observing how the iPad seemed effective in focusing the student's attention on a reading game for

longer than previous teaching methods, a six-week intervention was designed that used a combination of eBooks and selected reading apps to supplement the one-on-one teaching he was receiving. Over the course of the intervention, noticeable improvements were reported in the student's concentration levels when using the apps, and modest gains in word recognition and comprehension test scores pre and post intervention were recorded. While the authors fall short of attributing these gains to use of the device per se (acknowledging the presence of intensive teacher support in their trial), they do speculate that the improved levels of attention "may have allowed Josh to engage in learning tasks in ways that typical classroom experiences do not" (McClanahan et al., 2012, p. 26) and could also have supported higher order thinking. They point to video recorded evidence of increased verbal self-correction and oral responses indicating personal reflection-on-performance ("where I can improve") as examples of this. They also comment such results are consistent with ADHD's optimal stimulation theory, with the device triggering higher levels of sensory arousal thereby prolonging concentration. Similar results were also noted by Saine (2012) when iPad apps were used with English as second language learners. She commented that the technology "captured their attention, making teaching more realistic… appealing and exciting" (p. 75). However, beyond anecdotal observations, no specific evidence was provided indicating any possible benefit from this for student learning.

In a more comprehensive mainstream study, Hutchison, Beschorner and Schmidt-Crawford (2012) used Mishra and Koehler's TPACK framework to conceptualise and plan the integration of iPads into general literacy instruction. Using teachers' existing planning as a starting point, they systematically explored different opportunities to use the device across a range of literacy tasks including reading, written and oral language, visualisation, and idea sequencing. Specific apps of different designs (content creation/consumption) were identified as suited to delivering learning objectives in place of traditional pen and paper modes. They were planned into learning tasks, and students organised to work with them in pairs. The range of apps included iBooks supporting independent reading, Popplet for generating plans and brainstorming, Sundry Notes used in written language, and Strip Designer for storytelling. Results from the study suggested the TPACK framework proved valuable for maintaining the teachers' focus on curriculum rather than technology integration, and was pivotal to

generally successful use of the device. Notable outcomes included perceived advantages from using more open-ended apps such as Popplet, where students could generate their own content and develop different layouts and formats they considered best represented their learning. Teachers felt the design flexibility afforded by these apps allowed students to be more creative and less constrained, unlike pen and paper modes they considered "limits them, just like a worksheet" (Hutchison et al., 2012, p. 19). Additionally, their study revealed the quality of students' use of iBooks for independent reading was highly variable. While some students quickly selected a book and maintained satisfactory focus, a number were observed selecting and opening and closing a number of books rather than reading them, while others appeared only to select "easy" reads. They concluded that teacher vigilance was critical to ensure independent student use of the device remained productive. This conclusion aligns with those of this author, who noted similar considerations in a study of iPads being used for building foundation literacy skills in five-year-old students (Falloon, 2013a; 2013b in press).

Research focus and question

The study this article reports on follows a 2012 study that investigated the use of apps with 5 year-old students for developing foundation literacy, numeracy and problem-solving skills. Details and results from this study have been published elsewhere (Falloon, 2013a; 2013b in press), but in brief, students were recorded using a specially developed observeware app as they independently tackled learning challenges and problems presented in 45 apps, most of which were of a content consumption (or response) design. This article presents early findings from data recorded of young students' interaction with apps requiring them to create rather than respond to content, with a particular focus on discovering any evidence indicating if and how they may provide opportunities to practise, reinforce or extend what has been learnt.

The research question guiding data collection was:

> What strategies do young students apply when using apps of an open-ended (content creation) design to demonstrate, practise or share their learning?

App designs

Presently there are nearly 50,000 apps in Apple's app store that have been classified as educational and suited for use in schools. Most learning apps targeted at young children take the form of games or activities designed to consolidate and practise learnt knowledge and skills, and many of these focus on early years numeracy and literacy development. These designs generally reflect a behaviourist view of learning, where students are presented with a range of examples requiring them to generate a response or answer, often within a set time frame or "against the clock". Correct responses are frequently rewarded by reinforcements such as virtual stickers on a star chart, dancing and clapping characters, or high-score points. Progression between levels (and access to problems of increased difficulty) is determined by the number of correct responses recorded. In this study, these are termed content consumption apps.

While apps of consumption design dominate, increasingly others are becoming available based on more constructivist views of learning, where students use them as flexible workspaces to practise and exercise learnt knowledge and skills, through the creation of their own content that can be shared and presented to others. These apps provide students with a range of tools and often contain embedded scaffolds that allow students flexibility to creatively present their learning in a range of different ways, rather than simply responding to predetermined onscreen prompts. For the purposes of this study, these have been termed content creation apps.

The research context

This study was undertaken in a class of new entrant/year 1 students in a primary school in a small semi-rural town in the Waikato region of New Zealand. The school has a decile rating of 7, and a roll of just over 400 students. The research class comprised 18 students (nine girls and nine boys) who had been at school for between 2 and 10 months. The class was taught by a female teacher of 17 years experience, who had been using a small set of iPads provided by Waikato University since March 2013. Most previous use had focused on consumption apps that were integrated into the students' reading and maths programmes as part of regular group activities. Learning games and activity apps were selected to reinforce and consolidate knowledge learnt during group teaching sessions.

Data for this study were collected during eight hour-long sessions spanning a two-month period from late June to August 2013, and explored students' use of content creation apps as platforms for exercising written and oral language skills. The selected apps were Popplet[1] (mind/concept mapping) and Puppet Pals HD[2] (students create oral stories using built-in or imported characters and images). Activities the students were involved in included using Popplet in pairs to develop writing plans for stories, while Puppet Pals was used initially to retell the story of 'The Big Sad Wolf'[3] (a professional production that the class had seen) and later to develop oral stories of school and personal events. Data were recorded during the class's normal literacy programme on different days each week.

Data recording and coding

A specially designed observeware app was used to record students while they were working on their tasks. The app was installed on all iPads and ran in the background while the students worked on their own app, recording all their finger placements and display activity as a .mov file. The recording app was activated and deactivated via a combination of finger taps in a designated place on the display, but other than that, no visible signs of recording were available to students. Audio was captured by a small USB-drive-type voice recorder that was attached via velcro to the device's protective cover (Figure 1). Recording the audio separately was required due to clashes with the sound generating codecs used in the students' apps causing the embedded audio-recording function in the observeware app to malfunction. Once recorded, the separate audio and video files were downloaded onto a laptop and later dubbed into a single file on a desktop computer using iMovie. In total, nearly seven hours of recording was completed, representing 15 different pair combinations. Just over three hours was recorded of the students using Popplet (6 pairs), with the remainder being while they were using Puppet Pals (9 pairs).

[1] See https://itunes.apple.com/us/app/popplet/id374151636?mt=8
[2] See https://itunes.apple.com/nz/app/puppet-pals-hd/id342076546?mt=8
[3] See http://www.newzealandplayhouse.co.nz/the-big-sad-wolf/

Figure 1. A typical device set up showing USB voice recorder attached to the protective cover

Each recording was replayed, and a paper time log generated that coded data according to activities or events the researcher observed or heard, which provided insights into strategies (and any influences on these) that students applied, as they created their content. These activities or events were classified thematically as follows:

a. Student dialogue or interaction with each other;
b. App design and operation supporting experimentation, correction, reflection, or improvement;
c. Accessing and using knowledge or skills (content and technical focus).

After initial coding, a representative sample of videos (and their time logs) containing examples of events was shared with a postgraduate student, with whom the researcher had worked during the earlier studies. He reviewed the interpretations, suggesting three minor changes to the sample. After significant discussion, two of these were agreed to. The researcher then revisited the coded data, changing six other events (coded as dialogue and reflection/experimentation) to be consistent with the reinterpretation.

Findings

A summary of findings related to themes a–c is presented in Tables 1–3 below. Tables have been used to display representative data samples rather than using lengthy text descriptions, given the substantial volume of video recorded. Data are arranged in three columns. The first provides a screenshot of the app display, illustrative of the activity or activities described in column two. Column three provides a transcript of recorded student dialogue related to the described activities. These are indexed to the recording time log for each pair. It should be noted that where relevant descriptions and quotes have been included of pair interaction with both apps, even though the thumbnail only illustrates one or the other. Initial letters of the students' first names have been used in attributing the dialogue for each pair, to maintain anonymity.

Table 1. Student dialogue and interaction

Thumbnail and notes	Sample recorded activities (both apps)	Sample recorded oral interaction
Puppet Pals (PP) – selecting actors for stories. Free version used did not support importing characters or using camera roll images. 	**PP: Clarifying instructions** how to select characters, number of characters able to be used. **Debating** suitable actors to support intended story plot (discussing physical attributes and appearance of actors as suited to intended roles). **Negotiating** actor roles (substitute images were needed to take place of actual production characters).	(PP) "OK, she can be the mother… and he (squirrel) can be the wolf… (A). I think the dragon can be the wolf 'cos it looks more scary (H-M)… umm… OK you're probably right – good idea… we'll make him the wolf" (A). (A&H-M, 3.08 – 3.18) "Look, it says you can only have 8 actors… we've got 8… we can't have any more… we'll have to change some…" (N). (L&N, 1.27-1.32) "We have to work out who's the best… who d'ya think should be the princess? (B)… that girl in the red dress… the other one's too old… (referring to fairy) (L). (B&L, 3.19-3.28)
Puppet Pals (PP) – selecting the backdrop/s for the story. Free version used did not support importing other images. 	**PP: Discussing** suitability of backdrop/s for intended story plot. **Negotiating** whether a single or multiple backdrops were needed and when they would be used. **Discussing** how backdrops could represent different environments (e.g., snow field as a sandy beach).	(PP) "We could use the castle for the house… that's where she could live… (K)… (pause) but she lived in the forest, K! (G)… I know, we could have the forest and the castle… and swap…" (K). (K&G, 4.10-4.19) "We need to have a beach… I want to have a beach with some sand on it, but there's none here. (B) (pause)… There's some snow. Maybe we can use the snow one… it sort of looks like a beach. Shall we try? (F) (B&F, 3.01- 3.10)
Popplet (Pop)– developing a mind map plan of a story to be written about themselves. 	**Peer tutoring - *technical focused.*** **Pop: Demonstrating and teaching** how to link popples, save work, change background colour or popple images, resize and align fonts, take and import images from camera roll etc. **PP: Demonstrating and teaching** how to enlarge and reduce actor size, record and play back sound, navigate between screens, delete recorded drafts etc.	(Pop) "You need to draw lines… with your finger… joining up the boxes… like this (demonstrates). You try now" (L&N, 3.13–3. 19). (PP) "You need to tap here (image button) to get your picture… now… find it… no… you need to move down (scroll images) (M). Like this? (F). Yeah… tap it now… (M) (M&F, 4.43- 4.58) (PP) "We need to save it don't forget… we forgot last time and we had to do it again… that button… up there. The one with the pointer (arrow)… (L&R, 21.31-21.37)

Popplet (Pop) – creating content 	**Peer tutoring - content focused.** **Pop: Helping** each other spell words, find letters on the keyboard, improve the quality of sentences ('thin' to 'fat'), use capitals, place full stops. **PP: Demonstrating and teaching** how transition of backgrounds and movement of props and images could be used to improve the story, how actors should speak and move when playing different parts.	(Pop) "How d'ya spell macaroni…? (N). M-a-c-a (pause- sounds out letters r…o…n…e – 'macarone')… r-o-n-e" (L). (L&N, 5.27-5.44) (PP) "We could have the castle come over the top of the forest, so it kind of looks like the princess is coming home…" (O&G, 12.12-12.17) (PP) "You need to move it more (the actor)… he's really excited remember… and make him loud… his voice. He should jump around (P&L, 17.20-17.31) (Pop) "We need to say more… Mrs. F said we need fat sentences. Tell what kind of hair you have… black… and… fuzzy…" (P&L, 9.03-9.13)

Table 2. App design and operation supporting experimentation, correction, reflection, or improvement

Thumbnail and notes	Sample recorded activities (both apps)	Sample recorded oral interaction
Puppet Pals (PP) Main screen where students recorded their stories and moved their actors and props. 	**PP:** Seven of the nine recorded PP pairs revisited the main screen between 2 and 5 times to refine and/or change their stories. This process followed considerable discussion between pairs about how changes could improve their story, or include elements that had been missed in previous drafts. Finger 'drag, drop, swipe' device operation and intuitive and flexible app design supported this (discussed below).	(PP) "We need to put in some stuff about the wolf… we forgot the wolf – you know… about him being locked up. (B). Oh… oh…um, we can go back. Don't save (the audio). We can do it again (L)" (B&L, 9.23-9.32) "Your speaking needs to be more shaky… and when we speak, we need to wiggle (the)… people (moves princess with finger)… like this… like they're talking (O). OK… we can do it again… (deletes recording). (O&Z, 14.56-15.09) "Look P, if we make them (actors) smaller (drags image to reduce size) it looks like they're going away (L). We can change ours so it looks like the princess is running from the wolf…" (P). (P&L, 11.32- 11.41)

Popplet (Pop) Mind map planning screen. Students created a series of popples to plan a story they were writing. 	**Pop:** Similar to (PP), pairs used the 'easy edit' and finger 'drag and drop' functions of Popplet to make frequent changes to their story plan, usually in response to feedback from their partner. Pairs were recorded taking multiple photos before choosing the best one, changing the arrangements of popples to better reflect the order of their story, choosing different font size to emphasise important words, and revising text to change 'thin' sentences into 'fat' sentences.	(Pop) "My… (Z). It's not how you spell 'my'… it's m-y… not y-m… you need to change it Z. (O). What? (Z). Change the letters… see! (O). (O taps backspace to delete reversed letters). Oh… thanks… m-y…my… (Z) (O&Z .52-1.07) "Shift the boxes. Drag them… you need to sort them like you're going to write your story with. Change where the lines go too (links)… you can tap them…" (B&D, 4.11-4.17). "Remember she (teacher) said we need to write fat sentences (G). What else can I say? (K). You could say your hair is brown and curly… (G). How d'ya spell curly? C… er.… l…e (attempts phonetically) (K). (G&K, 5.32-5.42)
Puppet Pals (PP) Experimenting with content 	**PP:** Six pairs experimented with actors and other content before deciding how best they could be used in their story. This included discovering the effects of resizing, rotating, flipping, zooming in and out of scenes (slider at bottom left of thumbnail), changing backdrops etc. These acts were different to those focused on improving or refining (above), as they occurred prior to any content being created. Experimenting appeared an essential activity for students working out how best to use the resources they had access to.	(PP) "Look A… you can make them big… (drags)… or small (drags back). We could do that to make the wolf hide behind the tree… (H-M)" (A&H-M, 6.16-6.22) "If you tap him twice… he turns around… (demonstrates)… so we can make him look the other way… he could be running (after the wolf) and we could turn him so it looks like he's yelling behind him…" (L&P, 3.33-3.43). "The ropes change the background… if we pull this one (demonstrates)… she's (princess) walking out of the forest… (pulls rope)… back home… (to castle)… (F&B, 8.08-8.15)

Table 3. Using learnt knowledge or skills (content and technical)

Thumbnail and notes	Sample recorded activities (both apps)	Sample recorded oral interaction
Puppet Pals (PP) Creating title for oral story and saving file 	**PP:** Students typed title for story into title pane, and then saved. **Spelling:** Recordings from 6 pairs indicated the use of phonetic spelling practising blends taught by the teacher. **Oral expression:** Recordings from 3 pairs referenced oral expression skills developed during previous drama lessons. Transference: Two pairs were recorded applying written story planning techniques to their oral presentation.	(PP) "Our holiday… (B). It wasn't a holiday… it was just the weekend… not like a holiday when we're not at school… (L). W…eee…k… n…d (phonetic blend sounding as she typed) (B). It has a 'e' sound too… at before the 'di'… (L). (B&L, 19.27-19.37). "You need to talk like the wolf… Z… not like you! Remember what Mrs. F said… we've got to try to make ourselves sound like them… like in our play… what we think they would sound like" (O&Z, 16.16-16.21). "It's like when we do a story… (you know)… we have t' think about the start and the end… (K&J, 5.23-5.29)
Popplet (Pop) Creating text for popples 	**Pop:** Popple content creation **Punctuation:** Peer correction of punctuation was noted in 3 Popplet recordings. These were mostly full stops, but one related to use of an exclamation mark. **Improving sentence quality:** Three pairs referred to the need to write 'fat' sentences (teacher description) containing more detail. **Adding emphasis:** Two pairs used different sized font to add emphasis to certain words. **Capitalisation:** Two instances of capital letter self-correction and two of peer correction were recorded.	(Pop) "Full stop… at the end… you forgot it. Go back… go back…" (Lu&P, 4.19-4.25). "…new sentence… do I need a finger space? (R). Space bar… at the bottom… that's it (J). 'I have got…' (R–to self). You missed the full stop… before the space… you need one here (J-indicating) (R&J, 7.12-7.19). "You have to put in more information… remember… 'fat' sentences… not 'thin'! (A) (A&H-M, 16.16-16.20). "Mrs F showed us how… you tap on the 'T' and you can make it bigger or smaller… (demonstrates)… see… there's the sizes…" (M&F, 10.43-10.50)

Discussion

Student dialogue through working in pairs

Recorded dialogue strongly indicates there were significant benefits for these students from working in pairs while they completed their app tasks. Verbal interaction helped clarify the purpose and parameters of the task, and how the resources they had at their disposal could best be used to meet these. For their Puppet Pal production this took the form of substantial debate and discussion related to the number and physical attributes of characters as suited to different roles, how backdrops could be introduced and combined to represent different scenes, and how props could be adjusted or interpreted for different purposes. In Popplet, some of the dialogue was more technical in nature, with students coaching each other on how to use the app and adjust appearance features such as font size and alignment, image selection, and Popple background colour and linking. Other interactions related more to content quality and accuracy, with much evidence of students proof reading and quality-monitoring other students' work, even though they were not engaged directly in creating it. A good example of this in the data table is P's reference to L's Popple content, and the need to create 'fat sentences' (a term used by the teacher and known by the students describing sentences with much detail). Many other examples were recorded of students helping their partner with spelling (O&Z; B&L), punctuation (Lu&P), structuring sentences (R&J) or providing advice that they considered could improve the outcome (L&P; P&L).

Whilst acknowledging this study did not compare the performance of students working in pairs with any working alone, evidence suggests the strength and nature of the dialogue that occurred between the students played an important role in improving the quality of outcomes produced. Despite the production of individual presentations and story maps, most recordings indicated high levels of collaboration between students, as each in turn scaffolded the learning of the other by providing timely and appropriate feedback in a wide range of areas, focused strongly on improving outcomes. Additionally, working in pairs provided these students opportunities to develop communication, negotiation, debating and evaluation skills, as they offered and evaluated the merits of suggestions and how they could enhance (or not) their work (e.g., A&H-M).

App design and operation supporting student reflection and content recrafting

In the majority of analysed cases (7/9 for Puppet Pals and 4/6 for Popplet), students were recorded going back to revise or modify sections of their work after initial completion. Recordings indicated the finger-based "drag, drop, swipe" interface was an important feature supporting convenient and intuitive editing, enabling these young students to quickly and easily make changes, corrections or modifications to their work, after the event. In Puppet Pals, this facility encouraged the students to experiment, finding out how characters could be manipulated (enlarged/reduced, moved in different ways) or voices changed to add greater impact or effect (O&Z; P&L). Similarly, in Popplet, students were recorded experimenting with different photographs and changing the layout and order of the Popples and links between them to better reflect the order of their story (B&D). This process was enhanced by app design that allowed students to trial the effects of their changes before committing them to a final product. For example, in Puppet Pals they were able to play back their produced video before saving it, or easily delete the audio and re-record it if they thought they could make improvements (B&L; O&Z). In Popplet, they could view their entire map before choosing to export or print it, and then edit, rearrange or modify the popples simply by tapping on them or dragging them with their finger.

The students appeared extremely adept at working the interface quickly and accurately, and could easily transfer technical and operational skills from one app to the other. The consistent button labelling and functioning of these two apps (swiping back and forward between screens, scrolling, tap selection of content or dialogue boxes, importing images, saving/exporting of work, keyboard appearing when text box selected.) meant students did not need to learn new techniques for each app. Instead, they simply applied what they had learnt previously, or quickly worked out any subtle variation that may have existed to get the result they needed. Touch display navigation appeared to assist this process by supporting easy button and content selection, without the need for greater precision and physical/eye coordination such as that required when a mouse is used. For students of this age, advantages from this more tactile form of interaction appeared significant.

Knowledge building and application

The content-creation (authoring) purpose to which these apps were applied, provided students with an ideal and relatively risk-free 'testing ground' within which they could practise literacy strategies taught in class. The most significant examples of this were their use of phonics skills to work out spelling, 'finger spacing' (space bar) between words, self and peer correction of punctuation and capitalisation, and using story-structuring conventions. Samples of these are included in the data tables. While not always executed accurately, many examples were recorded of students sounding blends and phonemes and then attempting to spell the words into text boxes, or editing punctuation usually after receiving feedback from their partner. As described previously, easy-edit app design significantly supported this process.

Also important to the provision of feedback and knowledge building was the role of the teacher. Students regularly received or sought feedback from the teacher and the researcher to guide them as they completed their tasks. Over the nearly seven hours of data analysed, evidence of teacher or researcher intervention was noted 37 times, involving 14 of the 15 recorded pairs. Of these events, 16 were noted as interventions of a mainly app technical nature (linking popples, changing background colour or resizing fonts, saving video stories, pausing or deleting audio recording, taking photos) while 21 were content-related (questioning/prompting to improve sentences, spelling cues – mainly help with blends, suggesting ideas for changes/improvements, reminding about full stops, word spaces). Most of the interventions also involved some form of affective feedback and/or encouragement of effort. While it is not known what proportion of these events were student or teacher initiated, strategic teacher intervention and support appeared an essential strategy most students used at some stage to build knowledge to improve their outcomes. Dialogue surrounding these events generally suggests such support was sought when peer feedback or embedded app features or scaffolds were unable to assist.

Summary

Earlier research by the author and others exploring the use of consumption apps for supporting literacy, numeracy and problem-solving skills in students, identified several factors that affected the 'learning value' able to be derived from them (Crichton et al.,

2102; Falloon, 2013a: 2013b in press; Saine, 2012). App features included access to scaffolds students could use to support their learning, clarity of instructions and learning goals, the nature of feedback provided (if any), distractions such as advertisements or web links, user-adjustable parameters and restricted content. Student variables included dispositional factors such as determination, reflectiveness and persistence, and cognitive capacities including levels of existing declarative and procedural knowledge. Findings indicated any learning benefits students gained from using apps of this design were the result of how they responded to app design and content constraints and affordances, and the extent of knowledge they brought to the table or could build through interaction and dialogue with peers.

However, results from this study suggest something of a different picture, when students are actively involved in creating rather than responding to or consuming content. Firstly, acknowledging the small volume of data analysed to date (seven hours and 15 pairs as opposed to 24 hours and 40 pairs for the earlier studies), findings tentatively suggest that when use is carefully planned, sufficient direction and structure is provided by the teacher, and students possess enough (in this case) literacy knowledge to construct suitable content, carefully selected apps of an open design can function as effective, engaging and flexible learning resources. Secondly, despite iPads being intended as single-user devices, findings strongly argue the benefit of students of this age working in pairs. The rich dialogue recorded was clear illustration of how students monitored and provided valuable and varied feedback to their partner as they worked. This not only improved outcomes, but also exercised valuable skills such as negotiation, compromise, evaluation and reflection, as ideas were shared and their merits debated.

Thirdly, the role of the teacher was crucial to ensuring students knew the technical basics of the apps, why the apps had been selected, and how they were expected to use them as literacy learning tools. Much early work involved deliberate whole-class teaching and modelling using Airserver and the Interactive Whiteboard (IWB), to demonstrate how to use the apps and to link previously learnt literacy knowledge to the tasks students were to do with them. The teacher's diligence throughout in providing formative feedback was also important, as was her periodic "checkpointing" of progress

by reassembling the class on the mat and getting the students to share and receive feedback on their work-in-progress, via the IWB. This highly active and engaged teacher role appeared pivotal to ensuring these young students remained firmly focused on the learning goals, and understood how best to use the apps to display achievement of these.

Conclusion

With increasing moves in schools towards using mobile technologies and implementing BYOD initiatives, it is important further research is carried out exploring factors that influence their effectiveness for learning. Innovative digital data gathering tools such as the observeware app used in this study, allow researchers to get accurate and natural student-use data that can be analysed to inform specific pedagogical strategies supportive of more effective device implementation. While it is relatively early days for tablet technologies in schools, it is vital this is undertaken immediately so the learning potential of these innovative digital tools can be optimised.

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