Introducing digital technologies into secondary schools to develop literacy and engage disaffected learners: a case study from the United Kingdom

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Content

This chapter reports a project, Literacy and Technology: Towards Best Practice, funded by the United Kingdom's Teaching Agency[1], involving five secondary schools in the East Midlands, United Kingdom. The project introduced digital technologies into core curriculum subject classrooms: science and English. The aim of the project was to identify whether new technologies, introduced into Key Stage 3 classrooms (11-14 years), could raise literacy levels of students with special education needs or disabilities (SEND), learning in a second language (EAL), with low levels of literacy, or identified by their school as disengaged with learning. The project proved successful with raised literacy levels and improved engagement in learning resulting in improved levels of progression. This chapter discusses the adoption, design and development of the use of new technologies.

This chapter begins with an overview of the project and a review of key literature relating to the use of digital technologies in the secondary classroom, including a critique of the digitally literate student and potential barriers to the introduction of new technologies in schools. The chapter then gives background information on the schools in the project including students and teachers, detail of the technologies that were used, why each technology was chosen, and how the teachers were trained and supported. There is then a discussion of how the technologies were introduced and implemented in the classrooms, subject content, the affordances of the technologies in learning and teaching, emerging pedagogy and considerations for teachers wishing to replicate this usage in their classrooms. The final section includes a discussion of the overall outcomes of the project and suggests that digital technologies can provide a more flexible and creative learning opportunity.

Increased use of Web 2.0 technologies across Europe has resulted in a developing body of research into how these technologies are integrated into the classroom (Niess, 2005; Bingimlas, 2009; Angeli and Valanides, 2009; Luckin, et al, 2012; Byrd-Blake and Hundley, 2012; Bennett et al, 2012). Reference to learners with perceived digital literacy skills, knowledge and understanding is varied. There is continued criticism in the literature around the technological capability of 21st century students who some see as digitally capable and others view as being good at using social media, but not in the application of technology to learning. For example Prensky (2001) claimed young people were digital natives having grown up with technologies and being confident in using a range of technologies. Bennett,

[1] The Teaching Agency was responsible for training new and existing teachers in England; recently merged with the National College for School Leadership.

Maton and Kervin (2008) and Kirschner (2013) countered this argument, while Jones et al (2010) argued that new technology use by young people is far more complex than the digital native portrayal. The view of teachers' capability has also been identified through literature such as Prensky (2001) aligning teachers to digital immigrants in that most had not grown up with technologies, and Young (2010) identifying an increase in self-proclaimed 'digital luddites' among teachers. There is now recognition that students in schools need to use a variety of digital technologies to enable them to become digitally wise (Prensky, 2010).

There is also much in the literature relating to emerging pedagogy and the use of new technologies. For example Tapscott (1999) identified that technologies support a changing pedagogy from teacher-centred to learner-centred. Mitra et al (2005) who conducted research using hole in the wall computers found that young people could teach themselves how to use technologies. Thomas (2011) identified that learning new technologies tended to be incremental rather than revolutionary.

The successful use of technologies in school classrooms indicates that the integration of technologies in classrooms is still in need of development (Lawless and Pellegrino, 2007; Hutchison, 2012). Some researchers have identified that many teachers restrict their use of technologies to presentation software, appropriate Web sites and school management tools (Harris, Mishra and Koehler, 2009). There is criticism in the literature relating to whether use of technology in the classroom can actually be transformational and engage learners (Kirkwood and Price, 2013) and criticism about the measured impact of technologies in the classroom to support learning (Angeli and Valanides, 2009; Higgins, Xiao and Katsipataki (2012). Indeed, Harris, Mishra and Koehler (2009) argue that the use of technologies in classrooms tends to be focussed on skills required by teachers rather than students' learning needs. Researchers such as Livingstone (2012) report mixed success when using technologies to improve students' performance.

The framework for introducing this project to teachers focussed on that developed by Mishra and Koehler (2006), which identifies the importance of pedagogy, lesson content, and confident use of technology (TPACK) by teachers, has been applied by other researchers and found to be an appropriate framework. This is supported by Higgins and Parsons (2009), Kramarski and Michalsky (2010) and Kennedy and McKay (2011) findings that professional development which integrates pedagogy and ideas within the context of the teacher's practice is more likely to ensure success. While Richardson (2010) comments on the need for teachers using new technologies to gain a better understanding of pedagogy and effective use of technology in the classroom before teaching with them. However, there are critics of the TPACK model, for example Archambault and Barnett (2010) argue that teachers can find it difficult to integrate each of the aspects of pedagogy, content knowledge and technology, thus questioning whether this can be useful. Graham (2011) also questions the validity of the TPACK framework and whether researchers can establish a clear rationale for the integration of each aspect of the framework.

Moving to more general professional development related to the use of technologies in school classrooms Bingimlas (2009), Drent and Meelissen (2008), Liu (2013) and Boulton and Hramiak (2013) identified that teachers need to be supported and may benefit from working collaboratively with others. In this project support and collaboration was provided throughout the project through the pairing of teacher with pre-service teacher and through the role of the university tutors who worked with each pair in their schools to support the project and create a supportive environment. Byrd-Blake and Hundley (2012) identified the need for

teachers to agree learning goals which focussed on student outcomes for technology integration in learning to be successful. In this project the learning goal for the teachers was using technologies to raise achievement in literacy and engage disengaged learners, thus a clear focus on improved results for students leading to increased social inclusion.

Project Overview

The project was led by a University, who has been involved in pre-service training for over 50 years and has a strong record of working in partnership with schools. In each school one teacher, a subject expert, was paired with a pre-service teacher with a strong background in computing able to provide support in using new technologies. Head teachers were invited to put forward an expert teacher in one of the core curriculum subjects: mathematics, science or English. No previous experience of using digital technologies was required of the expert teacher, rather a willingness to develop skills and work with a pre-service teacher who would provide support in setting up the technology and providing support in the project intervention lessons. Brief contextual information relating to each school is set out below:

School A was an Academy for children aged 3-18 years with approximately 50% of students White British and half from minority ethnic backgrounds, over 25% with English as an additional language (EAL), and approximately 40% with special educational needs and disabilities (SEND). The group chosen for the project was a year 8 (12-13 years) mixed gender literacy class with 22 students, 8 of whom had English as an additional language (EAL) and 4 students identified by the school as disengaged with their learning. The group was working at National Curriculum (NC) literacy levels 2-4, which is below expectations (levels 4-5 being the expected level). The content knowledge focussed on writing persuasively and developing key language features. The chosen technology to support the lessons was PiratePad which facilitates real-time collaborations allowing students to simultaneously edit a text-based document amending and improving their own and peer's work, with a chat facility which provided opportunity for additional communication.

School B was a church funded school for 11-18 year olds. For the project a year 7 (11-12 years) literacy intervention class was chosen. This group comprised 15 girls who were identified by the school as having low literacy levels with 56% working at below NC average reading age by 2 years. The chosen technology was a wiki, collaborative software which allows authors to create and edit developing ideas, concepts and understanding. The subject content focussed on creative writing and writing summaries. The wiki was chosen as it would allow students to develop their own work and also work collaboratively thus providing opportunity for peer feedback and extended learning beyond the classroom.

School C was a state school with students aged 3-19. The group chosen was a year 9 (13-14) mixed gender group. There were 18 students, 12 who were EAL with first languages including Bengali, Polish, Slovakian, Chinese and Portuguese. Eight students were on the Special Educational Needs (SEN) register, with 7 students receiving individual additional support and 4 students identified by the school as disengaged with learning. The students in the class were working at NC literacy levels 2 to 4; the norm would be levels 5 to 6 for this age. The subject content was the development and understanding of poetry. Two technologies were chosen: PiratePad, and Corkboard. The content knowledge was poetry, specifically identifying and developing elements of poetry such as synonyms, onomatopoeias and metaphors.

School D was an 11-18 Church school. The group chosen was a year 9 science group with 14 students. Five students were working at below NC literacy levels (levels 2 to 4) and 2 were identified as disengaged with learning. The subject content was different methods of metal ore extraction and reactivity; this involved working in groups to complete experiments which students then wrote up individually. PiratePad was chosen because it enabled real-time collaboration, Wordle, a technology which generates word clouds from text to identify key elements of the experiments, and Corkboard as a plenary tool for individual research to be shared with the group.

School E was a church school for 11-18 year olds. A year 9 science group was chosen which had 20 low ability students, 7 of whom had special education needs and disability (SEND) and 5 who were disengaged with learning. The students in the class were working below NC literacy levels for the UK. The chosen technologies were a wiki and Wordle.

The first stage in the project was to pair each expert subject teacher with the pre-service teacher and identify their roles. While the roles were not prescriptive each pair worked in a similar way. The expert teacher identified the content knowledge and developed the subject element of the lesson and resources. The pre-service teacher set up the technology for each lesson and uploaded subject knowledge resources. Working together each pair developed the lesson plan and identified appropriate pedagogy to support the lesson. In each school the expert teacher delivered the lesson, with the pre-service teacher providing support when the students were using the technology(ies). Reflections on the lesson and planning for the following lesson were carried out collaboratively. By the end of the project the expert subject teacher had gained sufficient confidence in using the technology(ies) that they no longer required additional support of the pre-service teacher. The impact on the teachers and pre-service teachers is discussed later in this chapter.

An initial training session for the teachers and pre-service teachers was held at the start of the project. The training session provided opportunity to demonstrate a variety of Web 2.0 technologies and engender discussion related to how these could be used to support learning in the classroom and identify appropriate pedagogy. The training involved including reference to the Technology Pedagogy and Content Knowledge framework (Mishra & Koehler, 2006) which identifies the importance of pedagogy, lesson content, and confident use of technology by teachers. The teachers and pre-service teacher then identified which class(es) would most benefit from involvement in the project. A discussion followed to identify the Web 2.0 technology most appropriate to the topic being taught; to identify how the impact on student learning would be recorded and the challenges affordances of the technologies they planned to utilise. This was then shared across the group and an opportunity to explore further technologies.

The projects in each school then commenced. Two of the projects are detailed below, information on all of the projects can be found at www.itte.org.uk.

School C

This Year 8 English group were working on a project which focussed on poetry writing in preparation for Year 9 studies, focussing on identifying and understanding the use of metaphors, similes and onomatopoeias, then writing different styles of poetry or song using each of these elements. The teacher and pre-service teacher had decided to use PiratePad and Corkboard for students to share the themes of their poems/songs. Both technologies enabled

out of school learning through continuing on the development of their poem/song and sharing these for peer feedback as homework. Initial preparation involved setting up both technologies and testing access through the school's firewall using a student's log in details. The expert teacher wanted the students to work in ability groups rather than friendship groups so that he could use PiratePad for differentiated learning. The expert teacher grouped the students appropriately into 6 groups and pre-service teacher therefore set up separate PiratePads for each group. The expert teacher identified the URL would be too long for the students to copy correctly so it was shortened through an online link shortener. A board was also set up using Corkboard so that each student was able to upload the title of their song/poem or upload an image which represented their song/poem; the latter choice particularly supported the students who were working in their second language with little English having arrived in the United Kingdom within the last 12 months.

There was initially some concern from the expert teacher that PiratePad had a chat facility which he viewed as potentially disruptive through students chatting off task. The students were able to utilise the chat facility to ask each other questions relating to the topic and clarify misunderstandings of language through working in their second language. There was also a teaching assistant (TA) in the lesson who was able to monitor the chat area and identify quickly who needed help. In the evaluation it was evident the teacher had really identified how to harness the chat area to ensure students were engaged, on task, and understanding the lesson content.

Much of work in this project was completed in groups. Group work without technologies requires students sitting in the groups in class and normally there would be a higher level of noise which can result in some students losing concentration. With the use of the technologies students did not need to sit in their groups; all conversation was online through the chat area and through the co-creation of online documents. Both students and teachers commented positively on the different atmosphere in the classroom created by this use of the technologies. The students reported a positive impact of using the technologies in learning. All of the students believed the technologies had helped to improve their literacy and achievement of the learning outcomes and they reported enjoyment at being able to share their work and communicate through the technologies. They particularly liked the online chat facility to support each other in their learning. Several students described learning through the technologies as 'fun'. The students also found a benefit of being able to look up words using online dictionaries was that their spelling improved. Their learning style became more creative as the students found the technologies aided their imaginations; they particularly enjoyed using images in Corkboard to share their ideas for their poems which they said added to their creativity.

Student 1 commented: '*I liked using this technology because I could work in a group but the teacher could see what I had done so I still got credit for my own work'*.

One group of 4 girls said they liked communicating with their friends, and making new friends in their groups. They liked the way the software highlighted their work. One student commented:

'*Rather than having to go and ask friends you can send them a chat*.' (Student 3)

'Much better because it makes you think more'. 'It is improving my work particularly English'. (Student 8)

However, students also reported some negative impacts which included frustration if their computer crashed (reported by two students). Some students abused the chat feature to have general conversations instead of focusing on the work set. The teacher and TA were quickly able to stop misuse of chat by establishing and embedding expectations. Initially some of the students were distracted by the multimodal nature of the internet. In a follow up interview the teacher said having used the technologies he would develop a set of user rules which would lead to shared expectations when using Web 2.0 technologies.

The pre-service teacher found that the students enjoyed using the Web 2.0 technologies and were eager to understand how the technologies could be used in learning. He also identified that when using the technologies the TA could follow the online chat and see which students needed help. The TA could therefore support other more students when using the technologies. He particularly noted that the students were able to engage with students they had not previously worked with through the technology commenting: '[The technologies] *enhanced a collaborative working environment and allowed students to mentor and support one another. The laptops aided low ability and EAL students as they could research good examples of poetry, translate words and visualise things through Google images.'*

The expert teacher had rarely used technology in teaching prior to the project and had lacked confidence in finding and using appropriate technologies to support his subject. He had previously only used slides and word processing. This project had given him confidence in using technologies. He commented:

'*This is very different and I think it is more exiting and engaging for the students. It was great to see students supporting each other and allowed me to have more time to talk to students as individuals and facilitate learning rather than being at the forefront of their learning.'*

He was particularly aware of the quieter, more purposeful atmosphere in the classroom when students were working collaboratively with the technologies. He commented very positively on how the students used translation websites to help them with their writing, establishing good practice for when they were doing homework. The teacher commented positively on the progression of the students who all achieved their learning outcomes and achieved at least one level higher in literacy than they had been predicated.

School D

This group was a small Year 9 science group with 14 students working below national average in literacy or disengaged with learning. The subject content was different methods of metal ore extraction and reactivity. The lessons involved students working in groups to complete experiments which the students then wrote up individually. A wiki was chosen by the expert and pre-service teachers because it enabled real-time collaboration, supporting the pedagogy for the lessons, Wordle to identify key words from the write up of the experiments and Corkboard as a tool in the lesson plenary for individual research to be shared with the group.

Prior to the lessons the pre-service teacher set up a wiki with a main page containing the information for each experiment, guidance for the students to follow and an additional page for each student to access. Each student's page had the same tasks displayed on it. A Wordle

was created for each lesson starter, see figures 1 and 2; the first lesson's was created using the text from the main page of the wiki and further lesson Wordles were created from student's write up of the experiment. Hard copies of both the wiki information and the Wordle were also provided as a strategy to support students who might find difficulty in moving between platforms. As additional support a help sheet with instructions, including screenshots, of the main task was also created. The screenshots were differentiated to support different abilities and were particularly useful to those who were working in their second language. Slides with differentiated learning outcomes and key learning points were also produced for use by the teacher in the initial stages of the project and at key points during the lessons. Figure 3 shows the main activity for lesson 1 of the project.

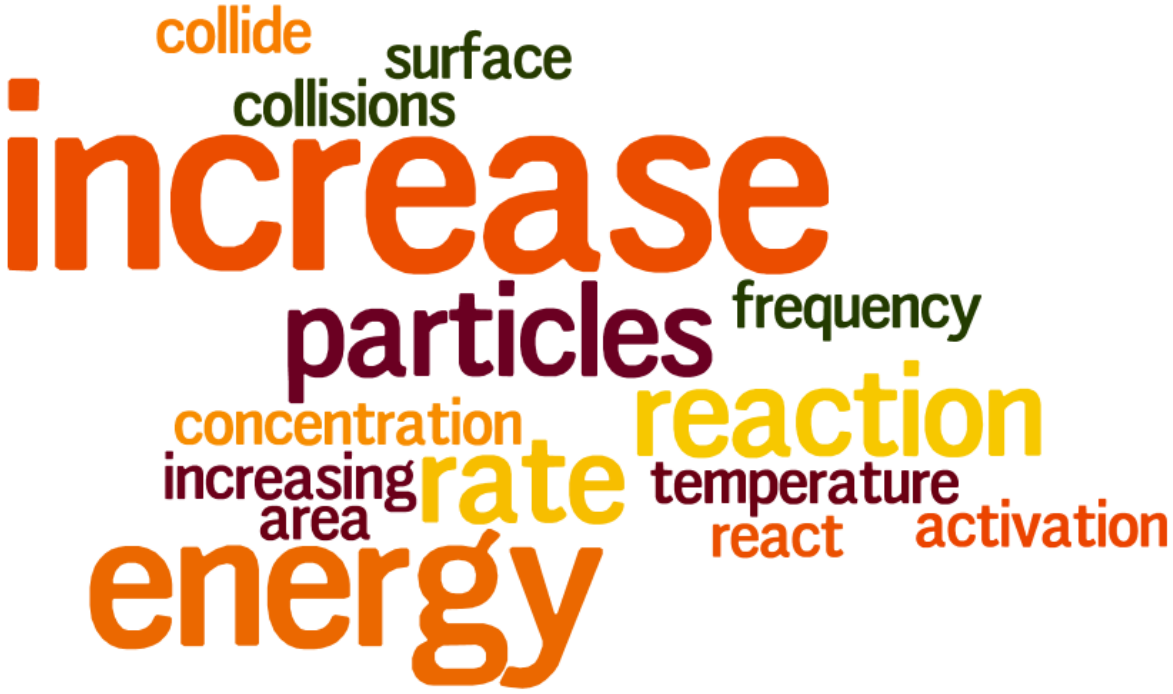


Figure 1: Lesson 1 Wordle

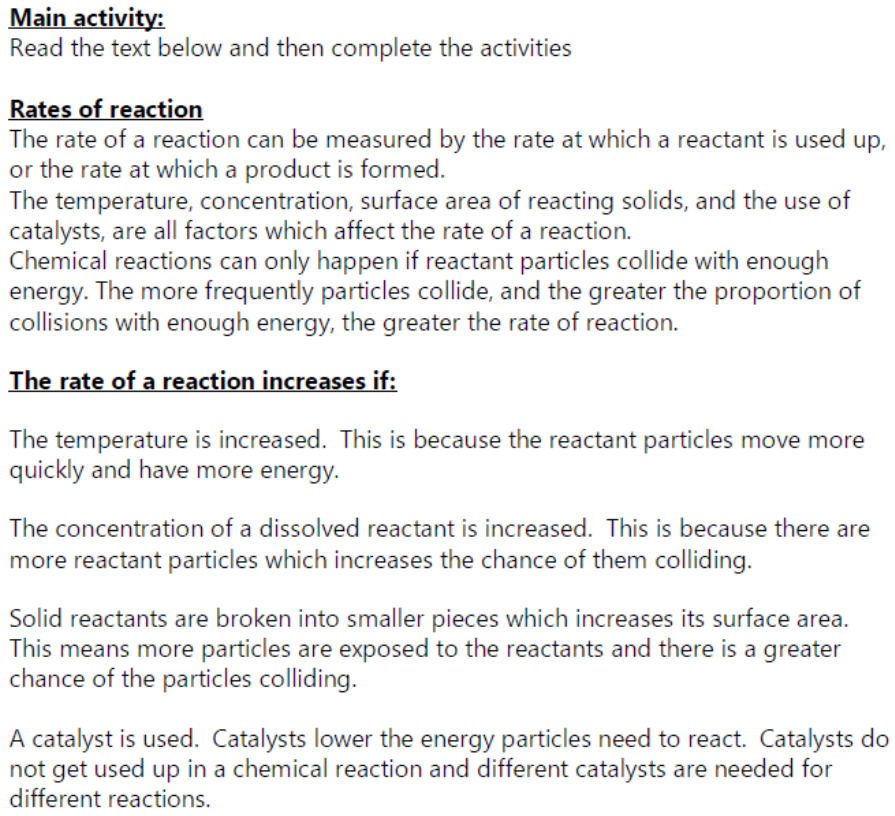
Link to the Wordle for this lesson

(PASS TASK) Starter activity:

Using the Wordle above, assign the correct key words to the following definitions and questions.

1) Particles need to do this to react [redacted]
2) How fast or slow a reaction is [redacted]
3) The minimum amount of energy particles need to react [redacted]
4) How many particles there are in a certain amount of space [redacted]
5) Breaking up a solid into smaller pieces increases this [redacted]
6) This makes particles move around faster [redacted]

Figure 2: Lesson starter activity



Main activity:
Read the text below and then complete the activities

Rates of reaction
The rate of a reaction can be measured by the rate at which a reactant is used up, or the rate at which a product is formed.
The temperature, concentration, surface area of reacting solids, and the use of catalysts, are all factors which affect the rate of a reaction.
Chemical reactions can only happen if reactant particles collide with enough energy. The more frequently particles collide, and the greater the proportion of collisions with enough energy, the greater the rate of reaction.

The rate of a reaction increases if:

The temperature is increased. This is because the reactant particles move more quickly and have more energy.

The concentration of a dissolved reactant is increased. This is because there are more reactant particles which increases the chance of them colliding.

Solid reactants are broken into smaller pieces which increases its surface area. This means more particles are exposed to the reactants and there is a greater chance of the particles colliding.

A catalyst is used. Catalysts lower the energy particles need to react. Catalysts do not get used up in a chemical reaction and different catalysts are needed for different reactions.

Figure 3: lesson 1 main activity

The benefits of the project to the expert teacher at this school were in seeing the students, who often struggled in class, being able to access the lesson and complete work more creatively through the technologies. The teacher stated that the level achieved for the students was much improved through the wiki. Final testing of knowledge and literacy levels indicated that the students had gained at least one level higher than predicted which the teacher said was due to the increased level of engagement and understanding through using the technologies. The teacher also commented that the TA who was timetabled to provide additional support with this class in science lessons had commented that she provided less support than usual when the technologies were being used stating:

'*It was really interesting to see how students in a normal classroom would struggle with the work rate but how these same students embraced the wiki and engaged in the activities set via the wiki. Notably, there were a number of students in that class that would normally struggle to engage with written activities in a normal science lesson but they did so extremely well via the wiki'.*

The group at this school also had a student with severe physical difficulties that resulted in her not being able to write. One to one TA support was provided to write for her which the student found frustrating. The TA commented that for the first time the student had managed to access all aspects of the lesson without her support due to the use of the technology. While

the student could not hold a pen, she was able to use a keyboard and mouse. The TA stated: *'I have been delighted with the progress of [the student] who has always struggled to write and keep up with the teacher. Having seen the impact of the technologies in this lesson I will investigate using them in other subject areas'*.

The students were asked to take part in focus group interviews at the completion of the project to identify the impact of the technologies on their learning. The students all commented that they found the sharing of work and collaborative aspects of the use of the technologies enabled the students to progress faster and felt they had learnt subject content at a deeper level. The students also suggested that this social constructive approach to learning was more enjoyable. They found that using the wiki was a positive change from the usual science lesson: '*everyone would be working on their own and just asking the teacher if they got stuck, however by using the wiki, everyone was helping each other out. We learnt more and moved on with the tasks without having to wait for anyone'* (Student 6). Student 8 commented: '*I found the wiki was a good tool for the peer assessment task as it allowed the me to read immediate comments on what I had done wrong on the first task before I moved onto the next task*. Student 9 who was identified as disengaged with learning commented that: '*it's much better* [using the technology] *than being in a lesson'*. Other students, such as Student 13, stated: '*I prefer working on the wiki because my work looked much neater*', while Student 14, who was identified as having a below average reading age, used the copy and paste function of the wiki in the plenary task to speed up correcting his sentences and commented: '*this was a real benefit'*.

The pre-service teacher, although science was not her subject area, found she had gained greatly from the experience of working on the project. She found that the project helped her to identify several key issues relating to her professional development; access to the lesson content through using technologies can, and often does, impact on the motivation of students; web based technologies can offer an innovative means to engage and motivate students in pursuit of progress; the importance of listening to students and their understanding of how tasks can be made more engaging; and that when faced with a class of seemingly uninterested students that have low expectations of their own capability, the consideration of alternative teaching and learning methods, supported by new technologies that will enthuse, motivate and engage students should be sought.

Unexpected consequences

There were some unexpected consequences that emerged the project. For example the teachers and pre-services teachers expected students would welcome the increased use of technologies in learning. However, their expectations were exceeded with a much higher level of engagement and achievement of learning outcomes. As a result the teachers disseminated the outcomes of the project within their schools and also revisited other technologies they had been exposed to in the initial training session. This enabled them to identify a range of technologies appropriate to their individual classroom and subject context. For example School D started to send out a Tweet of the Week for students and parents, which has steadily grown in popularity spreading to other subjects, and explored technologies such as mind mapping and animation software.

Most of the technologies facilitated student-centred learning reflecting Tapscott's (1999) view that technologies move learning from teacher-centred to learner-centred. The students enjoyed learning and creating knowledge in groups, identifying a key affordance of many

new technologies; the way in which many of the technologies record individual contributions to group tasks. The English teacher had been concerned at the outset of the project that students used 'slang' when using new technologies such as MSN and Facebook and they may project this onto their school work. There are many complexities around using different types of English language in different situations, however the school's expectations of the correct use of English, reinforced by the teacher at the start of lessons, resulted in the use of correct use of English in most of the student's work. However, when the chat facility in PiratePad was utilised students reverted 'slang' English reflecting their use of social software outside school. Before using chat facilities teachers may want to establish a set of principles such as 'no slang'.

All of the teachers were surprised at the increased level of intrinsic motivation, particularly from girls, when the new technologies were used. Teachers also commented on the improved 'pace' in lessons when the technologies were used which again reflects the notion of increased student-centred learning when technologies are adopted. Other learning from the project included the need to manage individual student's opportunity to copy work; this is easily identified but would need including in a set of principles for using new technologies. Students could also delete the work of others; again this needs managing by the teacher. There were difficulties experienced by some students in reading a lot of text on the screen. However, new technologies do allow for audio or video to be embedded which would provide additional support for these students.

The impact on pre-service teachers was also surprising. The purpose of their involvement was to help them to develop a greater awareness of lesson planning and an opportunity to reflect collaboratively with an expert teacher outside their own subject area. However, all of the pre-service teachers identified an improved understanding of cross-curricular work and the development of digital literacy skills with an improved knowledge of pedagogy when using new technologies. The pre-service teachers also welcomed the opportunity to support teachers who were not experts with using technologies, reporting this developed their leadership skills. The project focussed on expert teachers and pre-service teachers, but the impact of the project extended to TAs. The TAs, once they saw how the students they supported could be more independent learners, achieve at a higher level and were more engaged, became excited about the potential of technologies in supporting SEND and EAL and have continued to explore and use new technologies in other subjects. As a direct result of the project at both schools TAs have been included in professional development focussing on using technologies and are now frequently asked for advice about the most appropriate technology for the students they support.

While the overall impact of the project was positive with students achieving higher levels, exhibiting deeper levels of understanding and finding learning with new technologies both motivating and fun it is important to acknowledge that this was a small project affecting only one subject in each school. It was not possible to identify whether the students would become bored and disengaged if technologies were used more widely and become the norm for 21st century learners as did the chalkboard for 20th century learners.

Conclusion

This project supports the findings of others, that technologies have the potential to raise the achievement of students, increase their engagement in learning and result in a greater enjoyment of learning. This project has also shown that technologies can be used to support an increase in literacy levels and provide additional support and opportunity to access learning for SEND and EAL students. However to achieve success careful planning is required and teachers need to adopt a framework such as the TPACK framework to ensure that they introduce technologies appropriately. This project indicated that TAs should be included in planning for technologies so they also develop confidence in using a range of technologies which will enable them to provide teachers with knowledge on which technologies to use with the students they support.

Technologies can support more creative working for example technologies can help EAL students as they can translate language which helps them to develop their literacy skills. Collaborative learning and social construction of knowledge can be facilitated through many emerging technologies. Students enjoy sharing each other's work and being able to provide feedback; new technologies can support teachers and provide more creative ways of planning for peer feedback which engage learners, thus actively involving students in learning development and processes of co-creation challenging learning relationships and harnessing interactions outside the formal curriculum.

In the United Kingdom we have large numbers of students for whom English is their second language. This creates tensions and challenges for teachers in their planning. The use of new technologies could provide opportunities to rethink how we support these students decolonising education and moving towards new pedagogies to extend inter-cultural understanding and developing transformative approaches to learning.However, teachers need support in using new technologies in learning and teaching and developing confidence in using a range of technologies appropriate to their individual classroom context and subject. We need a workforce of teachers that are digitally wise with regular training on new technologies and opportunities to share professional development, as well as modelling excellent use of technologies both for pre-service teachers as part of their training and once qualified. Our education needs to be future-facing refocusing learning and teaching to consider emerging technologies to engender greater creativity.

We finish this chapter with a final comment from the teacher at School D

'[The project] has left me with a perpetual understanding of how using Web 2.0 technologies can be utilised in the science curriculum, across all key stages, not only to promote literacy but also active involvement and collaborative working. The enjoyment of students involved in this project was paramount to being inspired to make further use of technologies'.

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