Exploring the effectiveness of new technologies: Improving literacy and engaging learners at risk of social exclusion in the UK.

Abstract

This paper explores the effectiveness of new technologies in developing literacy within subject disciplines of secondary school students at risk of social exclusion. The research was undertaken as a collaborative project across five schools, including qualified and pre-service teachers in the United Kingdom. This paper provides an overview of the study and presents key findings related to impact on student progression and engagement and impact on teachers. The research indicates the affordances of the software supported more flexible, collaborative and creative learning opportunities, improved literacy and engagement with learning.

Keywords: Professional development; School culture; Teaching practice; Student achievement; Teacher collaboration; Social exclusion; Collaboration.

1. Introduction

Engaging students who have low literacy levels[1], are learning in a second language, or those disengaged with their learning, is challenging for many teachers (Byrd-Blake & Hundley, 2012; Trigwell, Rodriguez & Han, 2012) and requires teachers to rethink their practice (Vescio, Ross & Adams, 2008). This paper reports an intervention using Web 2.0 technologies in secondary schools in the United Kingdom (UK). The purpose was to identify its potential to raise literacy levels in subject disciplines for students with low levels of literacy, English as a second language, disability or those identified by their school as disengaged in learning. Five secondary schools (11-18 years) led by a university research team, took part in this year long research project which was part funded by the UK's Training Agency[2] (TA).

[1] For the purposes of this research the definition of literacy is 'literacy includes the key skills of reading, writing and communication that enables pupils to access different areas of the curriculum' (Office for Standards in Education, 2014: 18)

[2] The Training Agency is the national agency responsible for the training and development of the school workforce.

The UK has undergone a significant revision of curriculum in secondary schools over the last three years with literacy now embedded within all subject disciplines. Research into improving literacy has identified that interventions for students with low literacy levels is essential (Brooks, 2007) with collaborative learning identified as particularly supportive (Slavin & Lake, 2008).

Increased use of Web 2.0 technologies in schools globally has resulted in a developing body of research on how to successfully integrate these into the classroom (Angeli & Valanides, 2009; Bennett *et al.*, 2012; Bingimlas, 2009; Byrd-Blake & Hundley, 2012; Luckin, *et al.*, 2012; MacArthur, *et al.*, 2001; Molebash & Fisher, 2003; Niess, 2005; Webb & Cox, 2004). However, the affordance of new technologies' contribution to the development of literacy in subject areas and engaging disaffected students is under-researched; this paper makes a contribution to knowledge in this area.

Reported research indicates integrating technologies in classrooms in the UK is still in need of development (Hutchison, 2012; Lawless & Pellegrino, 2007) with many teachers restricting their use of technologies to 'presentation software, learner-friendly Web sites and management tools' (Harris, Mishra & Koehler, 2009: 393). There is criticism in the literature relating to the use of technologies in the classroom and whether they can be transformational, engage learners and impact on student progression (Angeli & Valanides, 2009; Higgins, Xiao & Katsipataki, 2012; Kirkwood & Price, 2013). Indeed, Harris, Mishra & Koehler (2009) argue that current use of technologies tends to focus on skills required by teachers to integrate them into their classroom, rather than students' learning needs. Other researchers such as Ertmer (2005) acknowledge student-centred learning is important to the successful integration of technology in education.

For the introduction of new technologies to be successful in classrooms professional development is viewed by many as essential (Avalos, 2011; Harris, Mishra & Koehler, 2009;

Vescio, Ross & Adams, 2008). Various theories relating to the development and use of technologies in the classroom are reported, some of which evidence the impact on professional development (Chism & Szabo, 1997; Guskey, 2002; Guskey & Yoon, 2009; Rienties, Brouwer & Lygo-Baker (2013). However, few evidence the impact of professional development on the progression of students (Flecknoe, 2002).

There are various frameworks presented for integrating technologies into the classroom. For example the Technology Pedagogy and Content Knowledge (TPACK) framework, developed by Mishra & Koehler (2006) from Shulman's (1986) PCK model, identifying the importance of pedagogy, lesson content, knowledge of students, and confident use of technology by teachers to ensure appropriate use of technologies in classrooms (Niess, 2005). Mukama & Andersson (2007) present similar factors for the successful introduction of new technologies in Rwandan classrooms. Other researchers such as Kilbourne & Alvarez (2008) identify that teachers need time to become able to use Information Communication Technology (ICT) critically in their practice. Byrd-Blake & Hundley (2012) draw on Holloway's (2006) factors which focus on teacher content knowledge and teaching skills, student learning goals, creating a supportive culture for a learning community, using student data to inform professional development planning and as part of the training itself, embedding training in the daily work of the teacher, sustaining training over time, allowing for feedback and coaching, providing opportunities for teachers to participate in planning their training and reflect on practice. Hodgkinson-Williams, Slay, & Sieborger (2008) and Meyer, *et al.* (2010) evidence that local support when developing new technologies is essential for the successful integration of new technologies.

However, these frameworks do not offer a lens for measuring impact of professional development. This research therefore draws on that presented by Guskey (2002) who identified 5

levels for measuring the success of professional development focussing on impact in the classroom:

Teachers' reactions	Level 1
Participants' learning	Level 2
Organisations' support and change	Level 3
Participants' use of new knowledge and skills	Level 4
Student learning outcomes	Level 5

This framework, originally developed for business (Guskey 1986), was adapted for teacher professional development (Guskey & Huberman, 1995). At the forefront of Guskey's framework is his view that 'for the vast majority of teachers, becoming a better teacher means enhancing student learning outcomes' (Guskey, 2002: 382). There are criticisms of Guskey's framework (c.f. Coldwell & Simkins, 2011) due to the levels not being presented consequentially, rather a set of conditions from one level to the next. Guskey's framework provided a structure for collecting data at different stages of the research, discussed later the Methods and Findings sections.

Vygotsky's (1978, 1981) theory of constructivism provided a theoretical framework for this research. Vygotsky proposed an alternative theory of learning to behaviourism which dominated teacher training in the UK during the late 20th Century, criticised as being too narrow and isolating (Liu & Matthews, 2005). Vygotsky (1978) identified that learning can take place by working individually or collaboratively through co-constructing knowledge, moving students from a zone of what is already known to a zone of proximal development, through the learner's construction of knowledge. The constructivist tradition has been further developed by others to recognise the role of the social environment in learning (Lave & Wenger, 1991; Wenger, 2009). While teachers now encourage collaborative and active learning in many countries, this research identified that Web 2.0 technologies can provide a

vehicle for collaborative and co-construction of knowledge. This process of learning arguably enables learners to develop their knowledge and subject discipline literacy through participating in activities designed by teachers, delivered through the Web 2.0 technologies to create a student-led environment.

Barriers to the successful integration of technologies in the classroom have been identified in the literature, for example Boulton & Hramiak (2013) identified barriers including lack of senior management support, insufficient time for planning, lack of access to technologies and school firewalls. Murray, Nuttall & Mitchell (2008) and Bingimlas (2009) identified barriers including lack of teacher confidence, resistance to change, negative attitudes, lack of time, accessibility, poor training and lack of technical support. Gaffney (2010) grouped barriers into specific areas of research and policy, school context, teacher skills attitudes and beliefs, student skills and knowledge and technology. Other studies also indicate access to technology in schools as a potential barrier (Hammond *et al.*, 2009; Office for Standards in Education, 2009; Pelgrum & Doornekamp, 2009).

There is thus an increasing body of research relating to the introduction of new technologies into school classrooms which identify potentially successful models and also recognise some of the challenges faced by teachers. The aim of this research was to test the efficacy of Web 2.0 technologies in improving literacy in subject disciplines for specific groups of students with low literacy levels, special educational needs or disability (SEND) or disengaged with learning and identify training and support needs for teachers in core subject disciplines in integrating technologies leading to improved progression.

2. Methods

The participants in this research were expert teachers, pre-service teachers and secondary school students, detailed below. This research represented a small scale evaluative case study (Bogdan & Biklen, 1998) using design based approach (Cobb *et al.*, 2003) with a view to improving practice and understanding of elements needed to introduce technologies to support literacy development for learners with additional learning needs, such as SEND, low literacy levels, English as a second language or disengaged with learning. The approach was both interpretivist and evaluative.

The overall research questions:

- How can the use of Web.2 technologies in core subjects in secondary schools engage disaffected learners, and learners with low literacy levels?
- What is the impact of training and supporting teachers to develop the use of Web 2.0 technologies, in developing literacy levels within different subject disciplines, on the progression and engagement of student's additional learning needs?

The research included data derived from a number of sources to add rigour to the work through methodological triangulation (Cohen, Manion, & Morrison, 2007) which are discussed below and presented in Table 1. Both qualitative and quantitative data were collected and analysed thus providing a range of indicators to identify evidence of any impact:

Quantitative data:

- teacher's baseline data of literacy levels for students prior to the start of the project; this was recorded and compared with final literacy levels at the conclusion of the project;
- attendance and class behavioural data was analysed as a measure of engagement, triangulated with teacher and student interviews and student evaluations;

- comparison with historical data. The teachers had each taught the same topic with a group of similar ability, learning experiences and age in the previous year; this data was used to compare student progression in literacy within subject areas thus using historical non-intervention data.

Qualitative data:

- baseline data of teachers' experience of using Web 2.0 technologies. This was gathered through a simple questionnaire relating to their use of a range of Web 2.0 technologies both in their personal and professional lives and their perceived confidence levels in using these from a scale of 1-10. This data were collected using an on-line survey tool, sent to the teachers and analysed prior to the initial training event. These data informed planning for an initial training event, discussed below;
- interviews with the teachers involved in the project at each of the schools, facilitated by the university tutor to ensure similar data were captured; individual interviews were held at the end of the project in each school. Each interview focussed on Guskey's levels, that is reactions to the initial training, teacher's individual learning, support from organisation and evidence of any change beyond their own practice, teacher's use of new learning and impact on students;
- at least one observation of a lesson within the project in progress in each school; field notes were taken and transcribed;
- focus group interviews with 10 students taking part in the project at each school (n=50); these were recorded and transcribed. Students were selected by the classroom teacher as representing a cross-section of abilities and background. One focus group interview per school at the conclusion of the project, each lasting between 20 and 40 minutes. These interviews focussed on Guskey's level 5, identifying perceived

impact on attendance, performance, confidence, emotional well-being, computer anxiety, computer attitude overall classroom experience;

- end of project evaluations completed by the students involved, again focussing on Guskey's level 5, providing opportunity to triangulate data from focus group interviews, teacher interviews and lesson observations.

Table 1 to be inserted here.

There was no planned intention to gather data from Teaching Assistants (TAs), however at two schools TAs approached the researchers to comment on the progress of the students involved in the project. These opportunistic findings are discussed below.

The project occupied a full school year: an initial training event (1 day); planning in schools; baseline data collection indicating teacher's prior experience of Web 2.0 technologies, student's literacy levels before and after the intervention, school data identifying disaffected students; the 'intervention', that is the project in action in classrooms; data collection and analysis on completion of the intervention stage; an event to share findings, critical reflections, evaluation, and dissemination.

Ethical guidelines from the British Educational Research Association were followed with ethical clearance for the project obtained from the lead university. Consent was gained from those involved including parental consent for the students involved in the research; all participants, that is teachers, pre-service teachers and students, were informed of the right to withdraw.

2.1 Analysis

Interviews, student evaluations and field notes were coded using grounded theory (Charmaz, 2012), patterns and relationships identified and compared, then integrated into key categories to ensure rigour of the analysis. The emerging categories derived from the data were: professional development, pupil progression, literacy, creativity, engagement,

enjoyment, well-being, language support, learning, collaboration, software affordances, and software barriers. The themes were then aligned to Guskey's five levels; this is discussed further in the Findings section. Quantitative data were compared with final literacy levels of groups involved, gender achievement and historical data, at the conclusion of the project.

2.2 Participants

The teachers involved comprised three male and two female, ages ranged from 30-48, all were qualified secondary teachers. Each teacher was considered an 'expert' by their head teacher in their subject. The pre-service teachers (n=7) were all post-graduate students, with a first degree in an ICT related subject who were developing knowledge of pedagogy; comprising two male and three females ranging from 23-30. The students who were involved in the project (n=92) were 12-14 years old comprising a mix of male (58%) and female (42%). In addition university tutors supported the project: one male and three females, aged 30-55; each tutor had worked as a teacher in secondary schools for a minimum of five years and a maximum of ten years prior to working at the university, with a specialism in Information Technology/Computing (IT/C), English or science.

Members of the project shared experiences throughout the project via the university tutors, thus an informal network and community of practice was established from the outset of the project (Cobb *et al.*, 2003; Byrd-Blake and Hundley, 2012). The university tutors followed similar roles to those outlined by Liu (2013), that is, facilitating interaction, providing examples of technology usage in classrooms, observing project lessons, supporting pedagogy and collecting and analysing data, thus developing a collaborative approach; they did not support the design of the lessons. The teachers provided 'expert' content knowledge and pedagogy, paired with pre-service teacher(s), to design lessons and use of appropriate technologies; they also taught the lessons within the project. Baseline data, indicated similarities to those identified by Collinson (2012); they were enthusiastic learners and

innovators, continually wanting to develop their teaching strategies and raise the achievement of their students; their experience of Web 2.0 technologies limited to social media, accessed in their personal lives, with the exception of one teacher who was using Wikis in her teaching.

The pre-service teachers provided additional support through their IT/C subject knowledge in the preparation of lessons, such as creating technology resources, setting up appropriate software, creating software passwords for students, and ensuring chosen technologies were accessible through school broadband firewalls; they also supported the lessons.

3. Project Overview

The head teacher from each school was invited to select one teacher from a core subject area of maths, English or science to take part in the project; of the teachers identified three were English specialist teachers and two were science specialists. In addition pre-service teachers, all students at the lead university, training to be an IT/C teacher on placement in each school at the time of the project, were identified to work with the teachers. Funding from the Training Agency enabled buy out of teacher time to attend an intensive training session at the university (one day) during which the teachers were introduced to the project, paired with pre-service teacher and introduced to a range of Web 2.0 technologies. Thus from the start of the project teachers involved in the project had local support, time, training and senior management support; all of which have been identified in the previous section as important to the successful integration of technologies into classrooms.

The initial training event, which followed design based research processes (Cobb *et al.*, 2003) was seen as crucial to the success of the project. At this event, project goals were shared and teachers and pre-service teachers and participants were introduced to a range of

technologies, supported with appropriate pedagogy. The aim was to ensure usage would be embedded, future facing and would empower students in co-creation of learning, supported by a range of differentiated support material, together with assessment of the subject knowledge through using the technology. As some groups had large numbers of immigrant students, there was shared agreement on pedagogy that extended inter-cultural understanding and encouraging transformation of capabilities in both the subject area and development of digital literacy. It was also agreed to use the technologies to extend learning beyond school and harness interactions outside formal learning through co-construction of learning.

In the UK teachers have been encouraged to use a 3-part lesson plan: introduction, main lesson broken down into activities, plenary. This was adopted for the project: the introduction comprised a subject related activity introducing students to the new technology(ies); the main section introduced new subject knowledge, supported by activities using the technology(ies); the plenary comprised a consolidating activity using the technology(ies) and a review of the use of the technology in the lesson to gather feedback to inform future development.

The technologies included Etherpad/PiratePad (collaborative real-time software which allows authors to simultaneously edit a text document and view participants' edits in real-time, together with a chat facility to enable further communication); Wiki (collaborative software which allows authors to create and edit developing ideas, concepts and understanding); blogs (allows reflections, sharing opinions and discussions in the form of an online journal); mind-mapping (enabling knowledge to be developed in a graphical/diagrammatic way to represent words, ideas, tasks, or other items linked to and arranged around a central key word or idea); CorkboardIt (collaborative software which facilitates students creating and sharing ideas); Wordle (software which outputs selected text

into word clouds) and Twitter (social media technology which enables students to express their opinions online and build knowledge collaboratively).

Each pair (teacher and pre-service teacher) identified appropriate groups for the project from those they were timetabled to teach with low literacy, English as a second language, disability and disengaged students. They then identified specific learning goals, appropriate activities, and sociocultural expectations of their chosen group to ensure a student-centred approach, identified by Harris, *et al.* (2009) to be key to successfully introducing technologies. Brief details of the project in each school are given below:

School A: an Academy (3-18 years): a year 8 (12-13 years) mixed gender literacy class with 22 students, 8 of whom had English as an additional language (EAL) learners and 4 students identified as disaffected. The students were working at National Curriculum (NC) literacy levels 2-4, which is below expectations (levels 4-5 being the expected norm for this age in the UK). The content knowledge focussed on key language features for writing persuasively; the technology chosen was PiratePad. Learning activities engaged the students with the software to encourage them to use key language features in their own writing and be able, via the software, to identify and use these appropriately. The significance of the software is that it allowed the students to work collaboratively and in real-time to amend and improve their own and other's writing.

School B: a church funded 11-18 school: a year 7 (11-12 years) Literacy Intervention class comprising 15 girls having low literacy levels with 56% having a below NC average reading age of 2 years. This group were learning the key features of writing summaries; the chosen technology was a Wiki. Learning activities included collaborative group work and individual work via a wiki, providing opportunity to share and provide peer feedback. Extended learning beyond the classroom was provided through activities, also via the Wiki.

School C: a 3-19 state school: a year 9 mixed gender group comprising 18 students, 12 with English as an additional language (EAL) with first languages including Bengali, Polish, Slovakian, Chinese and Portuguese. Eight students were on the SEND register, with 7 students receiving individual additional support and 4 students recognised as 'disaffected' by the school, having problems in engaging in 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 focus of the lessons was the development and understanding of poetry. Two technologies were utilised to engender learning: CorkboardIt enabling students to share ideas with peers for individual poetry writing and PiratePad, chosen to support students in writing poems, and identify elements of literacy, such as synonyms, onomatopoeias and metaphors.

School D: an 11-18 Church school; a year 9 science group with 14 students, including 5 with low literacy and 2 students having high ability but identified as disaffected learners. The students in the class were working at NC literacy levels 2 to 4. The group were learning different methods of metal ore extraction and reactivity, working in groups to complete experiments, followed by individual write up. PiratePad was used to encourage collaboration in researching different ore extraction in groups, with CorkboardIt as a plenary tool for individual research to be shared with the group.

School E: an 11-18 church school: a year 9 science group with 20 low ability students, 7 of whom had SEND and 5 who were identified as disaffected with high levels of disengagement. The students in the class were working at NC literacy levels 2 to 4; below UK national average. This group used a Wiki and Wordle to learn key factors affecting the rates of chemical reactions.

The limitations of this project were the number of schools involved and the lack of comparison with a concurrent group's data due to the type of student. It is acknowledged that results may be different if more schools had been involved, however the schools are

representative of schools in large cities in the UK and internationally; the teachers had all taught the same topic with the same ability and type of student in the previous year; a comparison of historical data was therefore possible. The community of practice established across the schools has not continued; teachers involved have commented that this is due to pressures on time. Future research may want to investigate what is required to maintain a cross-school community of practice and how technologies can support cross cultural collaboration.

4. Findings

In this section the impact on teachers and students is examined through the lens of Guskey's (2009) framework for measuring impact. Quotations from teachers and students are reflective of the majority of responses.

4.1 *Impact on teachers*

Guskey Level 1

Throughout the training event participants were able to share socially situated knowledge within the context of their unique classrooms by critically reflecting on their practice; found by Kilbourne & Alvarez (2008) to be a key factor in successfully introducing new technologies and developing aspirational lessons, using appropriate technologies to enhance the student experience and transform learning (Kirkwood & Price, 2013). All participants rated high levels of confidence in using the technologies and appropriate pedagogy at the end of the event (Rienties, Brouwer & Lygo-Baker, 2013); confidence building being viewed as key to the successful introduction of technology into the classroom (Livingstone, 2012).

Guskey Level 2

Teachers reported ownership of the project and their professional development rather than something imposed on them. For example

> I found the training and project very flexible which meant that I could engage with technologies that would suit my classroom and my students. To me this helped with the success of the project in my school. (Teacher AA)

This was particularly noticeable in post-intervention interviews where teachers stated they wanted to explore other technologies and how these might be embedded in their teaching.

Guskey Level 3

Post- intervention interviews identified four of the teachers had shared their use of the technologies with other colleagues beyond their discipline, thus suggesting wider impact and higher levels of confidence as well as potential organisational change. For example in School C the teacher in the project led various events to share the use of Web 2.0 technologies across the school. In School D as a result of the project the teacher has increased the use of Web 2.0 technologies to new subject areas and introduced Tweet of the Week to keep students and parents in touch with Science Department activities and homework; this is being replicated by other Departments in the school.

Guskey Level 4

All teachers in post-intervention interviews identified professional development and a change in their professional culture. For example teacher DA stated that the project had helped move her professional practice forward by taking her first steps in using Web 2.0 technologies. The project helped her reflect on how the process of learning might change and become more student-centred through the use of technologies. She reflected positively on

lesson outcomes and believed that the technologies increased creativity in planning lessons and helped students to learn and improve their literacy skills commenting

> The way the learning was structured and supported through the use of technology made the learning more student-led, encouraged students to collaborate and motivated me to be more creative in my lesson planning.

All teachers made comments relating to improved engagement, for example Teacher EA stated

> It 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 raise literacy levels within my subject but also increase active involvement and collaborative working. The enjoyment of students involved was paramount to being inspired to make further use of the Wiki in another topic which focused heavily on written explanations associated with humans and their impact on the environment.

Guskey Level 5

The teachers each reported a growth in student-centred learning, reflecting findings by Ertmer (2005) and Harris, Mishra & Koehler (2009) to be essential to the successful integration of technology in education. All teachers reported increased progression and engagement of learners.

Teacher CA had the least confidence and experience of technologies. This teacher commented that she would not have used the technologies had she not been part of the project; she reported immediate benefits to her students both in terms of increases in literacy

levels within her subject and increased engagement in learning. This teacher was particularly aware of the change in the learning environment in the classroom as a result of the technologies and the increased engagement of disaffected students, commenting

> I have seen a complete change in [student C6]; he rarely engages in learning and is very reliant on the TA. Through this project he has become more independent, is working collaboratively and has increased his literacy by 3 levels … this [use of technology] is very different and I think it is more exiting and engaging for the students.

4.2 *Impact on students*

Drawing on Guskey's framework the impact on students relates primarily to Level 5. However, it could be argued that evidence of impact on student learning outcomes was due to the teacher's use of new knowledge and skills developed through the project resulting in creating a different learning environment.

The quantitative data enabled measurement of student progress while qualitative data enabled identification of the perceptions of students (O'Rourke, Main & Ellis, 2013). At School A, students commented on how they welcomed the chance to work collaboratively with peers using the Web 2.0 technologies. Critical discussion developed during the project amongst the students relating to which language features to use and how to incorporate them into their writing was observed and commented on by the teachers.

Focus group interviews evidenced there was a changed atmosphere in all classrooms with 78% of students commenting on the low level of noise compared with the level of noise normally experienced with group work requiring oral collaboration. The reduced noise was due to the collaborative nature of the technologies which stimulated group work without

students having to discuss orally or sit with their group members. The students commented that this was a positive experience, enabling them to concentrate more and thus learn at a deeper level.

Over half of the students commented in focus group interviews that they felt they had more freedom to experiment with their ideas and were able to work at their pace, revisiting terminology and theory to reinforce their understanding. Two thirds commented that the technologies helped them practice their literacy skills as they could 'read what others had written' (Student A12) and add their own comments. Those using the Wiki commented it was helpful to read other pupil's work which motivated them to improve their work and enabled them to work collaboratively.

From the end of project evaluations completed by all students 83% commented that they had enjoyed using the software with 46% using the word 'fun' when referring to using the software with all of the students working on poetry finding PiratePad and CorkboardIt enabled them to be more creative:

> 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. (Student C4)

> Much better because it makes you think more and work differently… It is improving my work particularly [my] literacy. (Student C6)

One pupil identified as disaffected by the school commented

> It's much better [using the technology] than our usual lessons. (Student D4).

Teacher AC (interview) observed that student's development of subject knowledge was quickly apparent, particularly learners with English as a second language, which may be due to the real-time nature of their writing when using the PiratePad/Etherpad software. Those with lower literacy levels in their subject wanted to immediately correct their work and enjoyed the opportunity to collaborate in a quiet and unobtrusive manner, for example student A3 commented he could see his work 'looking good', reflecting increased intrinsic motivation and sense of well-being.

Overall student progress in literacy was analysed drawing on quantitative school data which was compared with historical data: National Curriculum (NC) literacy levels within the subject discipline at the start of the project, projected levels for the end of year and literacy levels within subject disciplines at the end of the project to identify value added improvement as a result of the intervention. Analysis of this data indicated that 87% of students achieved higher levels of literacy, most improving by one National Curriculum level, with 14% percent improving by two levels and one student improving by three levels. Comparison with historical data identified an increase of 25% overall. All students recognised as disaffected, had engaged with the technologies; some remaining on task throughout the lessons which was 'outstanding' according to teacher AA.

The data indicates that the use of Web 2.0 technologies contributed to the level of engagement and progression in literacy. End of project evaluations, completed by students, indicated 82% of the students commented they enjoyed the lessons using technology(ies), with 63% rating their own engagement in the lessons as higher than usual. Over half of the students commented that the technology used in the lessons helped them to learn content knowledge more than in traditional lessons where technology was not used, while 63%

believed the software developed their understanding to a higher level, and that the technology impacted on their learning more than usual.

An unexpected consequence impacted on one pupil at School E who had severe physical disabilities; this student's disabilities meant she was always reliant on a TA to write for her. Through the use of Web 2.0 technologies she was able to work independently and progressed at a faster rate than both TA and teacher had observed without the intervention. As a consequence of this project her teacher plans to use more technology with students with disabilities and increase training for the TA team to increase the use of appropriate technologies to better support students with physical disabilities.

5. Discussion

Reflecting on Guskey's (2002) framework for professional development, the initial one day training event at the start of the project clarified the learning outcomes for the project. Funding provided time for teachers to critically reflect with the pre-service teacher (Kilbourne & Alvarez, 2008). Baseline data collected from the teachers identified their needs and informed planning for this training event. The structure of this event enabled teachers and pre-service teachers to synthesise their new knowledge of using these Web 2.0 technologies and appropriate pedagogy into their own discipline and unique classroom (Angeli & Valanides, 2009; Kirkwood & Price, 2013). There was a change in the way lessons were organised, planned and delivered through the technologies (Harris, Mishra & Koehler, 2009). Researchers often find evidencing impact on student learning the most problematic; in this project there was clear impact through levels of higher engagement of disaffected students with participants reporting greater confidence in learning and increased motivation.

Teachers reported improved student learning (Vescio, Ross & Adams, 2008), and changes in professional practice and thinking in terms of how Web 2.0 technologies might support their teaching across their discipline and beyond the project. Students reported the development of cognitive skills and an enjoyment of using the various Web 2.0 technologies. TAs reported increased achievement by the students they supported and greater engagement, particularly by those with English as a second language and special education needs and disability. We would therefore argue evidence of cognitive and affective impact (Flecknoe, 2002).

Mishra & Koehler (2006) and Rienties *et al*. (2013) found that professional development frequently separates technological development from content and pedagogical knowledge. In this project the training focussed on developing participants in using technology within their discipline and subject related pedagogy, thus synthesising 'knowledge about tools and their affordances, pedagogy, content, learners and context' (Angeli & Valanides, 2009: 158). This process enabled the participants to develop a 'forward-looking, creative, and open-minded seeking of technological application … for advancing student learning and understanding' (Harris *et al*. 2009: 399) within the context of teacher's discipline and their unique classrooms.

Livingstone (2012), drawing on Passey *et al.* (2004), reports improvements in motivation rather than learning outcomes through the use of ICT. Livingstone (2012) argues that digital technologies can support a student-centred notion of education; this was supported by the student participants who found the technologies enabled them to work at their own pace and, where collaborative technologies were used, peer support and collaborative knowledge development was enhanced.

Many of the students commented on how the use of technology made their learning 'fun' which reflects findings by O'Rourke *et al.* (2013) and may account for the higher level of

engagement by disaffected students. Students reported a higher level of satisfaction with their learning experience which reflects findings by Flecknoe (2002), Trigwell, Rodriguez & Han (2012) and Livingstone (2012), while teachers recorded students' enhancement of higher order thinking and learning (Jonassen, 1999; Liu, 2013; Rienties, Brouwer & Lygo-Baker, 2013). The affordances of the software, together with the enthusiasm of the participants enabled more flexible and creative learning opportunities. It could be argued that these findings indicate Web 2.0 technologies, when used appropriately in class, improves the well-being of students.

Comparison of the five schools involved in the project found clear similarities in the engagement of students through the technologies and similar levels of increased performance by students. While others, such as Cooper (2006), have identified gender differences in the use of technologies these were not evidenced in the data collected. Cooper (ibid, p331) proposes a model for a gender-based digital divide, however when students were questioned about computer anxiety and computer attitude no significant gender differences were identified. When comparisons in progression and achievement were analysed there was again insignificant gender difference.

Bingimlas (2009), Boulton & Hramiak (2013) and Drent & Meelissen (2008), propose that for professional development relating to the integration of technologies to be successful, teachers need to be supported and may benefit from working collaboratively with others. Support and collaboration was provided throughout the project via the pairing of teachers with pre-service teachers and through the role of the university tutor. A learning community, loosely established through the university tutors across the schools, developed but has not continued beyond the project; instead teachers reported communities of practice developed organically within each school and across subject disciplines. The collaborative nature of this research project supports the view of Liu (2013: 40) that professional development 'through a

professional learning community can benefit teachers in promoting new teaching practices in supportive environments'.

Byrd-Blake & Hundley (2012) found that professional development was successful where teachers agreed learning goals which focussed on student outcomes. In this project the focus was on raising literacy progression in subjects and engaging disaffected learners; the focus for the teachers was thus on 'concrete learning goals and tangible results in student learning' through the development of appropriate learning outcomes (Byrd-Blake & Hundley, 2012: 564) both of which were achieved in the project.

6. Conclusion

This paper has reported a technology focussed design based research intervention with evidence of success in contributing to raising student progression in literacy levels in subject disciplines and increased engagement in learning by disaffected students in five secondary schools in the UK. While focussed on UK schools findings are transferrable to international countries where Web 2.0 technology is increasingly been used both within classrooms and to support cross cultural collaboration and cross platform access. This research has evidenced impact on teachers and students who were challenged in terms of additional learning needs. Guskey's (2002) framework provided a structured approach for identifying the levels of impact through a project supported by head teachers and acknowledging change in institutions beyond the project. While impact on students was mostly around Guskey's level 5, we would argue, drawing on evidence from this study, that student learning outcomes were a result of teacher's development through levels 1-4. Vygotsky's theory of learning through co-constructing knowledge provided a theoretical framework for the research. Teachers have developed student-led environments through Web 2.0 technologies which supported students

with SEND, learning in a second language, or disengaged from learning, to a zone of proximal development.

A consequence of the project was increased confidence of teachers in successfully using new technologies they were previously unfamiliar with in their classrooms, resulting in raising literacy achievement and engaging disaffected students. Students reported greater engagement, 'fun' with learning, a greater sense of and confidence in learning, increased motivation and progression, and an improved classroom atmosphere. Pre-service teachers reported they applied their experience from this project to schools where they are now employed as full-time teachers; anecdotally they have also fed back that their involvement in this project has given them new confidence in leading on the development of new technologies in their schools.

Key outcomes from the project provides further evidence for the developing body of research, in particular the importance of support through training focussing on pedagogy, lesson content and learning outcomes, student data, the use of the technology, the opportunity for teachers to critically reflect on their developing practice, support over time and the recognition that each classroom is unique. Overall the affordances of the software, together with the enthusiasm of participants supported more flexible and creative learning opportunities. The project found valid evidence that Web 2.0 technologies, introduced into classrooms with clear learning outcomes for students can be successful. Teachers involved in the project have continued using these technologies, with 75% reporting increasing support of colleagues across their school in the use of new technologies.

An output of this research project is a resource pack, aimed at the professional development of teachers in using Web 2.0 technologies which is free to use and can be

downloaded from the Association of Information Technology in Teacher Education web site: www.itte.org.uk.

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