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Teachers learning to use the iPad in Scotland and Wales: a new model of professional development

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Abstract

In learning to use a new technology like the iPad, primary teachers adopt a diverse range of experiential, informal and playful strategies contrasting sharply with traditional models underpinning professional development which emphasise formal courses and events led by 'experts' conducted in formal settings such as the school. Since post-PC devices like the iPad have been linked with transformational educational learning, there is an imperative to better understand how teachers can be encouraged to use them more effectively. Despite their growing popularity in schools, there is little research to indicate how and under what circumstances teachers learn to integrate these technologies into their daily practices. This paper uses data collected from two national studies of iPad use in Scotland and Wales to propose a new model of professional development. This model reflects findings that the teachers reject traditional models of sequential, or staged, professional development (often led by external providers or 'experts'), in favour of a more nuanced and fluid model where they learn at their own pace, in a largely experiential fashion, alongside their pupils in a relationship which reverses the traditional power nexus. The model has the potential to inform professional development for both trainee and serving teachers in learning to use the iPad in the primary classroom.

Introduction

Teachers' professional development in the use of ICT as an instrument for teaching and learning has long been recognised as a key factor in the successful integration of technology into the classroom (Tearle 2003). It is also understood how the personal use of ICT by teachers supports their confidence and competence, increasing the likelihood they will transfer these digital literacy skills into their classroom practice (Burden 2013; Fisher, Higgins, and Loveless 2006). This article proposes an original model of professional development which takes account of these skills, and those of learners, in terms of the successful integration of the iPad into the primary school classroom. It is suggested that this model can be used at multiple levels, both to inform teacher training programmes and to support the continuing, situated, professional learning of primary teachers in their own classrooms.

Most existing literature on professional development with technology focuses on how training should be structured and is concerned to identify distinct elements and phases which participants are likely to experience as they pass from being novices into experts (for example, Fisher, Higgins, and Loveless 2006; Harland and Kinder 1997; Joyce and Showers 1980; Mishra and Koehler 2006). These models and frameworks are largely sequential in nature and assume linear patterns of progression through different phases according to the needs and readiness of the learner. They may not, however, take full account of the pedagogical affordances and the more intuitive nature of learning presented by mobile devices such as the iPad. As such, there is a need to reconsider the

whole sequential nature of these models and develop a new model reflecting how teachers, and trainee teachers, learn to use the iPad.

This is necessary as mobile technologies, such as iPads, have evolved rapidly in recent years to the point where they are now conceptualised as a serious alternative to the fixed computer and indeed the portable laptop (Johnson, Levine, and Smith 2009). They are smaller and cheaper than many traditional computers, whilst still offering users many of the same affordances and features as their predecessors (e.g. multimedia, social networking, communication and geolocation capabilities), often at a greatly reduced cost and expense (Johnson, Levine, and Smith 2009; Naismith et al. 2004). In addition, and key to many of the functions, iPads, and other post-PC devices can connect to the internet and offer a 'high degree of possible user-customisation via multiple applications (Apps)' (Murphy 2011). Consequently, educators all over the world are investigating what mobile technologies, especially the iPad, can do and how they might be used to do different things in order to 'transform learning into a seamless part of daily life, to the point where it is not recognised as learning at all' (Naismith et al. 2004).

With growing pressures to adopt mobile technologies, teachers have become both the object and subject of change, making professional development and learning an essential, but problematic, necessity for teachers, teacher educators and school leaders alike (Zhao 2013). Previously, traditional models of training were considered adequate for the needs of a relatively stable workforce operating in a predictable and largely static context. This is no longer the environment educators find themselves operating within and in a complex, uncertain global landscape, career-long professional learning for teachers, rather than 'training', has been identified as an essential prerequisite where change is regarded as a constant, rather than a one-off event (Burden 2010; Fisher, Higgins, and Loveless 2006; Fullan and Hargreaves 1992).

The rapid deployment of mobile technologies such as the iPad into schools in many countries in recent years has introduced an additional layer of complexity for teachers, and teacher trainers, dramatically altering the dynamics of their various learning spaces. This has encouraged many to reconsider their traditional roles and practices as 'experts' and educators and, with it, their thinking about the nature of professional development. Various studies have shown how mobile technologies such as the mobile phone, and more recently tablet computers, can be used by teachers to support a diverse range of personal professional learning activities which include reflection on-and-in practice (Aubusson, Schuck, and Burden 2009); problem-solving (Greiff et al. 2013); collaboration (Kearney, Burden, and Taipan 2015) and knowledge construction (Peng et al. 2009). However, although it is increasingly expected that teachers at all stages of their career will integrate the use of mobile technologies in their classrooms to support or transform teaching and learning, little research has been undertaken to understand and explain how they might do this most effectively and what might be the implications for the various forms of initial teacher training.

Developmental models of technology adoption and integration by teachers

Many models and frameworks have been proffered to explain the complex process of technology adoption and some of those most commonly adopted to explain the integration of technology into teaching are reviewed in the following section. These models apply as much to trainee teachers as to serving teachers, so in this review, when referring to teachers, we are describing the professional development of both.

Most existing models of professional development are characterised by a prescribed, rather than emergent, design (Williams, Karousou, and Mackness 2011). In many cases, it is expected that teachers will progress through them in a sequential and linear journey reaching up to the higher levels where they are deemed to be operating as 'experts' rather than 'novices' (e.g. Mishra and Koehler 2006; Puentedura 2014). In their review of technology integration showing the progress of teachers as 'expert' users, Hixon and Buckenmeyer (2009) revisited a large number of theoretical models which had attempted to explain how teachers learn to use and implement technology into their daily practice, noting how most of these were sequential in nature with clearly demarcated stages or phases which teachers tend to advance through in a largely incremental and linear fashion. However, in negotiating the early stages of this, or indeed any other model, teachers have to overcome what Ertmer (2005) describes as first-order barriers, which are incremental, but reversible, changes in current practice with no change in existing structure or beliefs. However, to move to the latter stages of the model (and by implication others), teachers need to overcome second-order barriers, which, by contrast, are irreversible changes that are the result of challenging teachers' fundamental beliefs, resulting in a new way of both seeing and doing things. Second-order barriers, thus, centre around teacher's fundamental beliefs and attitudes about pedagogy and the teaching and learning process itself. As such, changing such deep-seated ideas may need a greater degree of challenge to current thinking. What will become apparent below, however, is that the technology itself does not have to provide the challenge, or to be challenging. The iPad, paradoxically through its ease-of-use, does appear to provide sufficient challenge (and/or pedagogic stimulus) to primary teachers' pedagogic beliefs to bring about fundamental changes in beliefs.

When barriers are overcome, at whatever level, teachers begin a journey in their use of technology. Attempts to map this journey have resulted in developmental models which posit how teachers expand and reconceptualise their attitudes and beliefs about their pedagogical practices shifting from 'teacher-centred to a "learner-centred" classroom' (Hixon and Buckenmeyer 2009). This shift to a learner-centred classroom is also found in some models of interactive whiteboard (IWB) adoption which fall into two broad categories, those involving use by pupils (meaning children of school age) and those that do not (Van Laer, Beauchamp, and Colpaert 2014.). For those that involve pupil use, the development of skills by both pupils and teachers, and their interaction, are a central feature. For instance, Beauchamp's (2004) IWB transition framework, where teachers move from using the IWB as a 'blackboard substitute' for the teacher, towards the synergistic use of IWB, where

> teachers are able not only to see how the technology works on a functional level, but are also able to see how this can be used to facilitate a synergy of learning in which pupils and teacher combine joint technical skills and teachers' pedagogic vision to create a new learning praxis. (Beauchamp 2004)

This new learning praxis is potentially easier to achieve when both pupils and teachers perceive a technology, such as the iPad, to be easy to use and useful in the classroom.

As such, this mirrors the key features (perceived usefulness and perceived ease-of-use) of the Technology Acceptance Model (TAM) in its many iterations since Davies' (1989) original model. It could also be argued that there are a range of external factors which affect both ease-of-use and perceived usefulness, and these will be discussed below. At its simplest level, it could be argued that the original TAM model is still applicable in the context of iPad acceptance in the classroom. However, this would only provide a very generic perspective where, if something is perceived as useful and easy-to-use, this positively affects both the attitude towards using and the intention to use, resulting in actual use of the technology. In addition, the TAM models do not easily allow for the distinction between teacher and pupil use of technology. What will emerge below is a much more

nuanced model of iPad adoption and use, where teachers take account of, and engage with, pupil's skills and knowledge. Such a model also reflects a growing body of research evidence that shows how teachers, and indeed pre-service teachers, learn with mobile digital technologies and, particularly for this study, with mobile technologies (Burden, Hopkins, and Pike 2010; Pegrum, Howitt, and Striepe 2013).

In addition, although many studies (e.g. Aubusson et al. 2009; Fisher, Higgins, and Loveless 2006; Kearney et al. 2012; Pegrum, Howitt, and Striepe 2013) show that teachers can make use of mobile technologies for personal reflection, to collaborate and share knowledge, such research does not focus on, or explain, how teachers learn to use these technologies for teaching purposes and to support learning in their classrooms.

iPads in education

In the face of a 'fast-paced iPad revolution' (Peluso 2012), research into the professional development needs of teachers when iPads are introduced into teaching is still at an emergent stage. Relatively little is yet known, or understood, about how teachers integrate the use of these devices into their classrooms, or if traditional models of professional development adequately capture the dynamics of this process. This is important as iPads have the potential to enhance the learning experience and transform teaching practice (see for example Clark and Luckin 2013.). Some small-scale case studies have advocated the need for formal training programmes to help teachers integrate the iPad into their daily routines and practices (Heinrich 2012; Henderson and Yeow 2012.), reflecting a traditional approach to professional development. Many other studies make no such recommendations, fuelling speculation that touch-sensitive devices like the iPad, which are intuitively easy to learn and use as personal devices, may also necessitate non-traditional alternative models of professional development (Burden et al. 2012.; Male and Burden 2014).

When considering what form these alterative models of professional development may take, we need to recognise that iPads motive and engage learners (Burden et al. 2012.), support collaborative and personalised learning (Clark and Luckin 2013 Clark, W., and R. Luckin. 2013.; Kearney et al. 2012) and are easy to use (Beauchamp and Hillier 2014.). The perceived benefits of iPads are not only limited to learners of school age, as international research suggests that they allow learners of all ages to develop flexible and active learning in areas as diverse as second language learning (Gabarre et al. 2014), undergraduate teaching of business (Howard, Phu, and Lan 2012.), graduate students (Zijian and Wallace 2012.), teacher professional development (Haihong and Garimella 2014) and teacher training (Pegrum, Howitt, and Striepe 2013).

Research into the use of iPads in primary and preschool settings is even more limited. Although international studies have focused, for example, on the use of mobile technologies in authentic settings (Burden and Maher 2014.), use in mathematics (Attard 2013; Kearney and Maher 2013.), special educational needs (Flewitt, Kucirkova, and Messer 2014; Murdock, Ganz, and Crittendon 2013) and particularly in literacy (Huang, Clark, and Wedel 2013; Hutchison, Beschorner, and Schmidt-Crawford 2012; Northrop and Killeen 2013; Simpson, Walsh, and Rowsell 2013) many of these are small scale and often limited to one setting. No study to date has looked in detail at the professional development needs of teachers based on the adoption and use of iPads in a range of settings in different countries with differing curricula.

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Purpose and aims of the study

This study uses the combined findings from two national research projects undertaken in Scotland and in Wales in the United Kingdom to develop an original model of professional development for primary teachers using the iPad. It should be noted at the outset, however, that the evidence below shows this development is inextricably linked to, and intertwined with, that of their pupils. The model is based on research where primary school teachers and their pupils used iPads as personal devices for a substantial period of their time in school, and in some cases, at home (Beauchamp and Hillier 2014 Beauchamp, G., and E. Hillier. 2014. Burden et al. 2012 This paper sets out to investigate the following research questions:

- How do primary school teachers learn to use and integrate iPads in their classroom practice?
- How do these findings extend our understanding of what constitutes effective professional development with mobile technologies such as the iPad?

Context of the study

For many years, education systems within the countries of the United Kingdom (UK) were dominated by the UK Government in England. In more recent years, the gradual devolution of powers, including education, has allowed Scotland, Wales and Northern Ireland to develop policies which reflect national priorities. This is particularly true of the education systems, and 'in Scotland, Northern Ireland and Wales education is clearly important in the construction of developing and/or re-affirming national identities'. (Beauchamp et al. in press.) Although these education systems do not directly impact on the use of technology, they do provide two distinctive and evolving national contexts in which the use of the iPad can be explored.

The study in Scotland was part of an independent evaluation undertaken in eight schools across six local authorities, although only the data from five primary schools across four local authorities are reported in this study. The schools in the study were selected through recommendations from their local authority (LA), but with mixed catchment areas providing a varied demographic. The main purpose of the study was to examine the impact on teaching and learning of the use of personal tablet devices (in this case the iPad) in schools.

The genesis of the research project in Wales was an existing informal network of six primary schools, again with contrasting demographics, who were working with their LA to develop their use of iPads. Some of these schools had been using iPads for at least a year and were considering buying more, while others had just purchased iPads and were introducing them into school. The head teachers of the schools and the LA adviser believed anecdotally that the introduction and use of iPads would be beneficial, but wanted to obtain more objective evidence. They therefore approached the local university to plan and undertake a research project to investigate the use of a range of stakeholders, including pupils, teachers and parents.

In both countries, there were inevitable variations in key factors (such as curriculum or patterns of iPad deployment and ownership) which could influence adoption and successful use of the iPad, so no attempt was made to draw comparisons between individual schools or, given the timescale of the studies, to identify the long-term impact of the initiatives on individual educational attainment or cohort assessment outcomes. We were also cognisant of the fact that that use of technology does

not automatically lead to increased achievement (Northrop and Killeen 2013 Northrop, L., and E. Killeen. 2013.) The results described below combine data from the studies in Scotland and Wales in which many common themes were identified. As this paper focuses specifically on the realities of using iPads in the classroom in teaching and learning, only the rich qualitative data from the pupil and classroom teacher interviews (rather than school leaders) are used, rather than contextualising quantitative data.

Research design and methods

Both studies used a mixed methods research design consisting of largely quantitative data collection from online surveys of parents (in both countries) and teachers (in Wales) and qualitative data gained from interviews with pupils and teachers in both countries. The online questionnaires for parents were common to both studies, but the teacher and pupil interview questions varied between the studies with the online survey of teachers only taking place in Wales.

More specifically, in Scotland, the research team drew data from initial (baseline) and exit surveys of parents and pupils; individual and focus group semi-structured interviews with the lead teachers and senior managers in each school; interviews with advisers and senior leaders in each of the local authorities; focus group meetings with pupils in each school (Years 3, 4, 5 and 6; age 7–11); lesson observations by the research team; and teacher reflective journals and pupil video dairies. In this paper, as stated above, only data from the teacher and pupil interviews are reported. In each of the project schools, approximately six pupils were tracked throughout the duration of the project and these pupils formed the basis of the focus group interviews. An additional focus group of pupils were interviewed at the end of the project to gain a different perspective. In total, 64 pupils were involved in the focus groups tracked during the project and an additional 60 pupils were interviewed in the final focus group interviews (total: 124 pupils).

In Wales, semi-structured interviews were conducted with a subset of teachers and groups of pupils in all six schools on the school premises at a time convenient to staff and pupils. One researcher from the team undertook all of the interviews with both pupils and teachers to ensure consistency. Interviews were conducted with pupils from years 1, 3, 5 and 6 (age 5–11) in small groups of five pupils per age group, making a total of 20 pupils interviewed for each school and 120 pupils overall. Members of the groups were chosen by the teachers and consisted of both boys and girls. Classroom teachers from the each of these age groups were also interviewed in one group of three or four in each of the six schools. The total number of participants reported in this paper are shown in Table 1 below.

	Schools	**Classroom teacher interviews**	**Pupil interviews**
Scotland	5	11	64
Wales	6	23	120
Total	11	34	184

All interviews in both countries were recorded for later analysis by the research teams. This analysis took the form of an iterative thematic coding exercise, where themes were identified separately in

each country and then compared. In reality, although the actual coding labels varied, nearly all important themes emerged from the data in both countries. These themes are reported below, alongside data from other sources (for instance teacher logs in Scotland) and findings from both countries are combined unless otherwise stated. Teachers (T) and pupils (P) from either country identified by the suffix S for Scotland and W for Wales and representative quotes are taken from both countries.

Findings

It is interesting to note that many similar themes emerge from different perspectives in both sets of interviews and these themes provide the component parts of the professional development model that follows. In reporting these themes, however, we have organised the findings into two groups for ease of reporting (teachers and pupils), but there was considerable overlap which is reflected in the resultant model. Although this model focuses on the professional development of teachers, we also need to look at what pupils say, as they are very influential in developing teachers' use of the iPad. As will be discussed in more detail below, their impact on teacher professional development is perhaps unique both in terms of the direct impact they have and how teachers welcome this, as opposed to more traditional support. As such, this symbiotic relationship is an essential part of the resultant model and the views of pupils are an integral part of developing any understanding of how teachers contextualise their own development. In addition, for those training teachers of the future, it is important to be aware of how pupils learn to use the iPad to equip student teachers with the necessary understanding of how best to support them, or indeed, how the pupils can support the student teachers.

Teacher themes

From formal training to vicarious professional learning

In both Scotland and Wales, teachers received formal training, based upon traditional professional development models, prior to using iPads in class with their own pupils. Although these formal training episodes were mainly acknowledged as useful by teachers, they were not regarded as essential and the amount of formal training required, compared to similar initiatives like the IWB deployment, was minimal. In Wales, the teachers regarded initial training as predominately 'technical', including how to use certain functions, tools and Apps. This was regarded as an important early stage of training, particularly for those with little or no previous iPad experience, but more limiting for those teachers with pre-existing basic knowledge and skills:

I think if you didn't know anything about iPads [the training] was very good. I already had an iPad so I knew most of the functions but I think if you didn't it was useful for showing you the basics. (W, School D)

Similar comments were voiced by teachers in Scotland, and teachers from both countries requested more classroom-based training and opportunities to observe context-specific pedagogical applications of the iPad by teachers working in classrooms similar to their own:

It would be great … to actually go in a classroom and see how they are being used by other classes in your own year. (W, School D)

Indeed in the Scottish study teachers formed their own personal learning network which they ran independently from the central project using an online forum, to share good practice, to ask questions of others amongst the group and to arrange for classroom swaps where teachers visited each other's schools in turn.

This willingness to move to more informal, self-directed learning (often outside of school hours and off school premises) was a key theme identified in both countries. The majority of teachers were clear that experimentation, independent learning and exploration were needed to find out what else the iPad could offer which they could use within their own classroom settings. This process is summed up in the response of a teacher from each country:

I think [teachers] definitely need some training to get them started but I think they need to take it home and just play with the iPad. Just having time to play and experiment with the iPad it invaluable. (W, S6)

We got them home to play with as well. And then I think, just after that, they came into the school and [name of another teacher] and I got one home each to use. So there has been those two little courses – and then just teach myself. (S T4, School A)

Playfulness, self-learning and experimentation

As the previous two comments illustrate, teachers reported how they learned to use their iPad at their own pace and in their own homes in preference to more overtly formal processes which might be labelled together as 'training'. Most of the schools in the two projects encouraged teachers to take their iPad home, often over the course of a holiday, although there was no obvious evidence, this was a strategic or even coordinated approach from the various schools and school leadership involved in the two projects:

We took them home on weekends and were encouraged to take them. (W, S5)

So we had that Easter break and we got a list of essential apps that we were going to need. So we had that time to go on and browse and play with it. (S T6, School A)

In relinquishing some degree of control and responsibility for training, however, many schools appear to have stumbled upon an effective tactic linked to a professional development element which is not widely evident in the research literature on this subject: playfulness. The term captures the essence of how many teachers learned to use and feel comfortable with this particular piece of technology, in contrast to the traditional, formal modes of training they normally experience:

Everyone wanted to play with them and the only way you are going to learn is to play on them. (W, S1)

Yeah. But then I'm kind of like that with most things. I would rather try it out than have someone tell me how to do it, so it's maybe a personal thing there. But yeah, I think play with it, I would definitely recommend. (S T5, School B)

This informal, playful model of professional learning about technology is relatively rare in that it falls entirely outside of normal professional development boundaries. It is not configured around any formal programme or agenda. It can occur both in the classroom with pupils (of which more below)

and in the teacher's own home, at times to suit them and their family. In the latter situation, it is often undertaken alongside their own children as evidenced in the following examples:

And I've got children of my own so it was quite nice to go on with them and have a look at things together because then I could see things that maybe would work well here with the class. (S T6, School A)

You use it in the classroom, and you ask the children also as well, 'What have you found out from this? Oh, how did you do that?' – and they tell you. And you just pick up on things. But you do just play with it at home. And it's not… That's not a bad thing to have to do. (S T2, School B)

An additional quality exhibited in their professional learning was their willingness to take risks, to experiment with the technology and to discover through play without fear of 'breaking it':

you need to get it and you need to just try things, trial and error, I think. When ICT came in first of all, when we started getting ten computers in the classroom, I think… Maybe not so much my generation but maybe a couple of generations before me, they were… If you touched the wrong button then you'd ruin it all and you can't… You've got to just follow the instructions. And it was very much like that, whereas this is not like that at all, you shake it and you've undone what you did. (S T2, School A)

And don't be afraid of them – you can't break them so just explore and have a play. (W, S6)

Situated learning and changing relationships

Many traditional models of professional development are predicated around a deficit model of learning whereby teachers are positioned in an asymmetrical power relationship with the trainer or external expert who is expected to redress their shortcomings. A similar dynamic also characterises the relationship between most teachers and pupils, and so, it was unexpected to find participants in both of these studies describing a relationship which was radically different. In both countries, teachers frequently described how their own learning was often co-constructed with their pupils in a far more symmetrical power relationship, which is not common in classrooms. In this co-constructed model of professional development, many of the teachers were conscious of:

This natural intuition that [the pupils] seem to have … this generation are almost born with a digital device in their hand … That's why it's important for staff to have a go as the children are always two steps ahead of us. (W, School A)

All my pupils had used one and were better at using them than me… They [the pupils] explained it to me in words I could understand so it was brilliant. (W, School A)

In both Scotland and Wales, teachers valued the opportunity to learn alongside their pupils in this respect and many appear to have deliberately harnessed this as a teaching strategy, happy to relinquish their traditional role as knowledge giver and expert:

They are happy to come and tell me how to do things, and I think as a teacher that is a big step for me as well, to say I am going to ask to children to get on with this. But for me to accept that these children possibly know some more about this app than I do, well that is okay, as I said to the children, I am learning as well, we are all learners. And I think for them to see me as a learner,

because children often think the teacher is the font of all knowledge and knows everything, for them to see me as a learner as well has been really good for them. (S, T8 School D)

This suggests that because the iPad was perceived to be intuitive and relatively easy to use, the learning curve for pupils, as well as teachers, was correspondingly low. This enabled pupils to operate at a level of parity with their teachers which is comparatively uncommon in classrooms. Numerous examples from each study, such as the following, point to the formation of collaborative bonds between teachers and pupils which are more commonly associated with more homogeneous communities such as the staff room:

We were often learning together and they would be 'Oh Miss I have found out how to do this' or 'I know how to do that.' (W, S5)

I think it's made it more of a partnership as well because they're quite comfortable with showing me things and knowing more sometimes than I do. (S T3, School B)

Indeed, for some teachers, this process of learning from and with their pupils constituted a new type of relationship which promised broader and wider benefits beyond the iPad project.

Assessment

Many teachers mentioned that the iPads could play a key role in assessment and concluded that 'for assessment they are a good tool' (W, S6). It is worth noting, however, that they made a distinction between their own open-ended assessments using the multimedia features of the iPad itself and the (pre-programmed) assessments provided by many Apps they had available. They particularly noted the use of Apps to control progression in activities and to provide instant feedback, but also noted the benefits of using the iPads to keep their own records of achievements. The use of video and sound recording for this purpose was particularly common in the teacher interviews. Whilst teachers acknowledged that in the past other technologies could do the same thing, they had often had to use a range of different devices to do this. They argued, as pupils in a 'digital hub' above, that having one device which could produce a range of different types of recordings made assessments more spontaneous, easier to organise and made saving them easier. Examples included:

With recording dance for example they are actually watching themselves back because otherwise they can't see what they are doing. It does help their speaking and listening as well because they are listening to the words they are using. (W, S2)

We use them for photographs or recording when they are doing oracy assessments so that is useful. (W, S3)

It was also suggested that 'from an assessment point of view I think it will become more and more useful.' (W, S1)

iPad use across the curriculum and even for extra-curricular activities and school trips

The vast majority of both teachers and pupils noted the versatility of the iPad as it was reportedly used across the curriculum, including educational visits. Both the use of various Apps and the ability to use the Internet allowed teachers to utilise the iPad for a range of different activities within various subject disciplines and also across the year groups.

It is adaptable because it can relate to any lesson at any time. (W, S4)

As we are developing we now have a set [of apps] for reception, set for year 1 and so on. (W, S5)

In terms of use outside of school (but in school time, such as educational visits), pupils reported that the iPad had replaced other devices and that:

We also take iPads on trips and take pictures and videos and stuff like that. (W, S3)

It's easier when you are going on a trip as cameras don't get all of it and it's a bit more complicated to get the video and stuff on and they don't really catch that moment you want. With the iPad it takes what you want so that's why it's better to take them. (W, S3)

We take iPads on trips as they are easier to use. (W, S3)

Pupil themes

Fun and play

Pupils in both studies agreed that using the iPad was fun, more like playing than learning, and this enabled them to learn more effectively because it was easy and intuitive to use:

It is a great learning opportunity I personally like the iPad more than any other learning device in the world. Not only do they brighten up lessons but they are easy to use! (S, Y5)

They enjoyed the wide variety of Apps and tools available through the device and saw the iPad as distinctively different to books and writing, which they equated with traditional learning. Pupils were aware that activities on the iPad had an educational purpose, but felt that the learning was 'disguised' which reduced the pressure of conventional learning:

It's just fun learning. On the iPad you are playing games but actually learning at the same time. On the computer there is BBC bite size but it isn't really fun. iPad games are easier to play and fun. (W, Y6)

The iPad as 'digital hub'

Whilst the pupils reported that the iPad was enjoyable due to its association with play, they also stated that the iPad was an enjoyable device due to its multimedia capabilities. Not only did pupils describe ways in which Apps could be used in various ways to support their learning, they also highlighted ways in which they used the Internet for research, the camera and voice recorder:

It is so fun because you can do everything on [the iPad] … you can read books, play games, get images, record videos all on one piece of technology. (W pupil Year 5)

This echoes comparable views about the IWB, where similar capabilities were noted leading to some labelling it a 'digital hub' (Beauchamp and Kennewell, 2013 Beauchamp, G., and S. Kennewell. 2013.; Cutrim Schmid and Whyte, 2012 Cutrim Schmid, E., and S. Whyte. 2012.; Kershner et al. 2010 Kershner, R., N. Mercer, P. Warwick, and J. Kleine Staarman. 2010.). The IWB, however, was often described as a hub as it could be used in combination with other peripheral devices (such as digital cameras or microscopes), but in the case of the iPad, these devices are contained in the iPad itself. This allows pupils (and indeed teachers) to combine actions more effectively, including switching

modalities, as they make decisions about how they will use the various features available. In this sense, it is similar to Beauchamp and Kennewell's (2013 Beauchamp, G., and S. Kennewell. 2013.) description of the IWB as 'not merely one of the resources to be orchestrated, it has features that afford the act of orchestration itself.'

Pupil empowerment

The majority of pupils in both studies had used an iPad or related device prior to their introduction into school, either of their own or a member of their family or someone they knew. Those who had not used one before felt they required very little support from teachers as they reported they could learn by experimentation given the interactive nature of the device. In common with the teacher interviews above, pupils also stated that they felt they knew more than their teachers about using the devices in some instances. All the pupils enjoyed the opportunity this provided to support their teachers in learning new technical skills and reported that this gave them increased levels of confidence and self-esteem. In common with teachers below, pupils also described the change in the dynamics of the classroom where iPads were used. We will examine this in more detail below, but it is summed up in a pupil quoted below:

It's funny because if [they] don't know something and you do, it's like you are the teacher and they have been downgraded as a student. It makes me feel good that I know something that a teacher doesn't. (W, Y5)

Discussion

Both of the studies in Scotland and Wales identified previously unreported findings relating to professional development. First, they suggest that teachers learn to use, adopt and integrate technologies like the iPads in a highly experiential and playful fashion which carries with it significant implications of how we think about and reconfigure traditional professional development and initial teacher training approaches. Second, they highlight how teachers co-construct their understandings and learning alongside their pupils in a process which is far more symmetrical than traditional power relationships normally allow. This has major implications for how and where professional development is situated since it may be increasingly inadequate to consider it as a neatly segmented element undertaken by teachers alone. In addition, it also has implications for how beginning teachers are trained to use the iPad, where this training should best take place and who should provide it. The implications of these points will be discussed in more detail below.

These findings are significant since they suggest the need for an alternative model of collaborative teacher–pupil learning which also has considerable ramifications for how teachers and teacher educators conceptualise their role and how they reconfigure their subsequent behaviours and teaching practices in response to these changes. Existing models for technology adoption by teachers, in particular, are linear and progressive in nature, often with an implied or actual hierarchy. In most models, as discussed above, there is either no role for the pupil or they only appear when the teacher has mastered a range of skills, even if the teacher is starting with no knowledge. Evidence from this study, however, suggests that a more nuanced model is required which reflects both the perceived affordances of the iPad and the fact that pupils are co-constructors of knowledge with their teachers from the very beginning of technology use. This collaborative, and mutually supportive, development means that it is impossible to provide a totally

discrete model of professional development of teachers as this would not represent the reality in the classroom. Although teachers will inevitably have different needs than pupils, particularly the pedagogic stimulus stimulated by the iPad, any model for professional development needs to represent the synergy of their joint progress.

Influences of the iPad on adoption and classroom use – towards a new model of technology adoption for iPads

In developing a model to reflect the influences of the iPad, the findings above suggest that we should avoid the linear structure and deficit model of learning which underpin many technology adoption and professional development models. Strong evidence has emerged from both studies that the central driving force in use of the iPad for both teachers and pupils is that it is perceived as intuitive, easy to use and hard to damage, further encouraging a spirit of experimentation and playfulness which was noted in the findings. Even when barriers or problems were encountered, the simplicity and intuitive design of the iPad encouraged teachers to solve problems without recourse to technical support in the traditional sense of external advice or specialists. Indeed, in the classroom, teachers and pupils provided support to each other, and both were prepared to involve other family members and friends as 'consultants' in solving problems. As such, the fact that the iPad is perceived as intuitive and easy to use by both teachers and pupils must be at the centre of any new model.

The intuitive nature of the iPad also affects the early support provided for teachers. From a professional development perspective, the data above strongly suggest that teachers do not perceive the need for any significant formal training and are very willing to learn in their own time, both in their classrooms and in more informal settings such as their own home. This again has implications for those training student teachers who may have to consider the resourcing and time allocation implications of this finding.

Other implications for those training student teachers relate to how pupils learn to use the iPad and the impact this has on lesson planning. The studies above show that pupils' early use of the iPad is mediated by their belief that it is fun to use. In turn, this enhances their belief that the iPad helps their learning and also enhances collaboration. Their willingness to explore the full potential of the iPad without fear means that they recognise the iPad as a 'digital hub' which provides access to a range of features they would previously have found in different devices. Using all these features, they perceive that the iPad helps them both in their learning and allows them to recognise opportunities to use in a wide range of educational contexts.

What is also particularly interesting is that teachers' willingness to listen to pupil voice leads to a greater sense of empowerment in pupils, as they both recognise opportunities to use the iPad in planned and spontaneous ways. This has the potential to increase interactivity with ICT as technology takes on a significant role in orchestrating classroom activity. In previous studies of the IWB, Beauchamp and Kennewell (2010 Beauchamp, G., and S. Kennewell. 2010.) characterised categories of interactivity with ICT and suggested that the ability of both teacher and pupil to influence the course of the lesson is a key feature of interactive lessons using ICT. The evidence above suggests that iPads may enable primary school classes to work at Beauchamp and Kennewell's (2010 Beauchamp, G., and S. Kennewell. 2010.) dialogic (learner ideas influence the course of activity), or even synergistic (learners contribute ideas equally), categories of interaction. This is

important as they suggest that there is a 'consistent suggestion in the literature that shifting the balance of interaction in classrooms towards the dialogic end of the scale would bring improvements to the learning process and consequently to attainment outcomes' (Beauchamp and Kennewell 2010 Beauchamp, G., and S. Kennewell. 2010.).

In this context, not only can pupils' suggestions influence how iPads are used in a lesson, but teachers' pedagogic imagination (Greene 2000 Greene, M. 2000.), and hence pedagogic development, can also be stimulated in new and unexpected ways as they perceive different pedagogic affordances of the iPad as they learn about new features from the pupils. In turn, as pupils see they are influencing the teacher, they gain a greater sense of empowerment and may be more willing to share their own knowledge and make their own suggestions for use as reported by the teacher below:

And what I tended to do as well was to look up apps that were suitable for the children and then tell them about them. And they actually did the same – they would go home and say, 'I found this app – can we try this one out?' So they really were quite enthused by everything. (S, S3)

It is suggested that student teachers need to recognise this potential and feel confident enough to listen to pupils to help develop their pedagogic repertoire.

Although pupils and teachers have travelled to this point by different routes, we now reach the point where pupils' sense of empowerment and teachers' willingness to use their suggestions has the potential to develop a self-perpetuating and mutually beneficial praxis. Figure 1 below provides a model showing the different self (pupils) and professional (teacher) development routes for pupils and teachers learning to use the iPad, and how this can lead to both pupil empowerment and pedagogic development of teachers.

Figure 1. Model of iPad professional development.

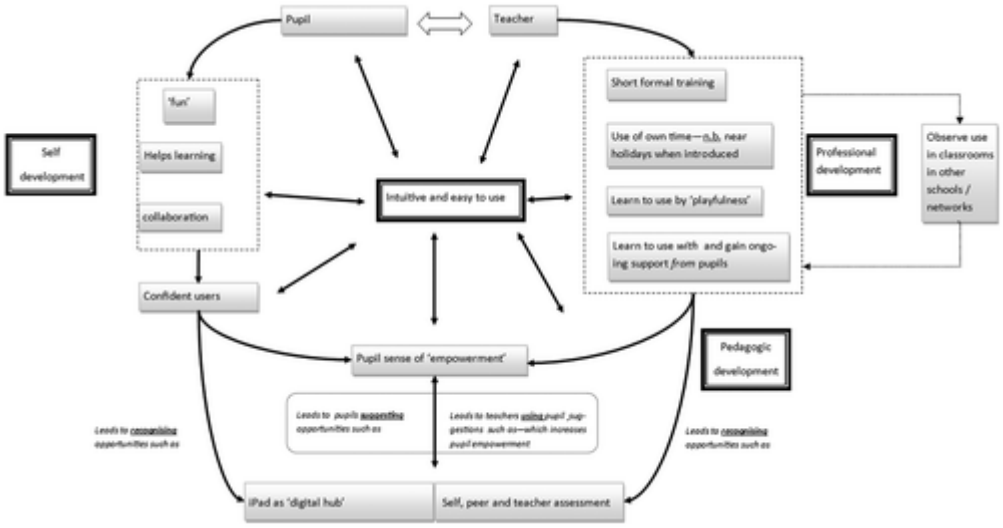

Figure 1. Model of iPad professional development.

In this model, we see the self-development of pupils and the professional development process for teachers, but both lead to a shared realisation of the potential of the iPad in teaching and learning. For pupils, this is predominantly focused on their perceived learning needs, but for teachers, there is

also the potential for pedagogic development as they see new uses for the iPad use across the curriculum.

As well as teachers currently working in schools, this model also has implications for student teachers and those providing training. For student teachers, it provides an understanding of how pupils both learn to use the iPad and how they think it positively influences their own learning. The model suggests that when planning to use iPads in the classroom, pupils need limited support and may work well collaboratively. In addition, they should not be afraid the iPad will be damaged by the pupils, providing normal precautions are taken. Student teachers also need to recognise that pupils may see affordances in the iPad that they themselves do not, and should feel confident enough to listen to pupils' suggestions about how the iPad could be used, even if it is not part of their original lesson plan. In terms of their own professional development, student teachers need to develop a 'playful' attitude to learning new skills and not be afraid to listen to the pupils in terms of specific skills on the iPad, but also suggestions for how to use pedagogically.

Given the above, there are also considerations for those teaching student teachers. The first of these is that student teachers will not require formal training beyond the very basic features of the iPad. Although potentially problematic in terms of resources, this research also suggests that student teachers would benefit from being allowed to take iPads home with them and 'play' with family and friends to develop further their skills for use in the classroom. In fact, the location of training to use the iPad is further complicated by the positive impact of pupils' learning. This suggests that either training in the classroom or the use of pupils visiting student teachers at their place of learning has a very beneficial impact. As student teachers develop their skills in using the iPad research suggests that one of the most important uses for a student will be in assessment, particularly the use of recording sounds and images. As this assessment takes place across the curriculum, and teachers reported above that they use the iPad in many different areas of learning, it would seem sensible that iPads are used in as many 'subjects' (particularly PE or outdoor activities) as possible if these are taught discreetly as part of initial teacher training programmes, rather than just in ICT or computing sessions.

Nevertheless, despite the great potential of the iPad reported in this paper, like all technologies, it does not provide all the answers for all teachers, student teachers and pupils, all the time. Central to increasing the number of answers, it provides is the ability of teachers in particularly to see the affordances of the iPad. Deriving from the work of Gibson (1979 Gibson, J. J. 1979.), the notion of an affordance is what an environment, such as a classroom or the resources within it (such as iPads), can offer to an individual or individuals. Importantly for this paper, Gibson suggests that the same environment can provide different affordances for different individuals. This is significant because, as Webb points out, 'Whether or not a person perceives an affordance depends on the information available as well as the person's disposition' (2005 Webb, M. 2005.). For teachers, the information available can be increased not only by their own perceptions, but also those of their pupils. Moreover, if, as we have seen above, their disposition is open to listening to these, the potential to exploit the perceived affordance(s) is increased.

Perhaps the greatest challenge for all teachers, at all stages of their career, is in seeing the unique affordances of the iPad and using them effectively. The iPad is not a panacea for the primary classroom, but evidence from both teacher and pupils strongly suggests it does provide new opportunities for enhancing teaching and learning. This is summed up by one of the Welsh teachers who stated that

There are two parts to it; yes they [pupils] are engaged by it [iPad] but then there are certain things you can do on the iPad that you can't do without them. When you use the iPad in a way that is unique to them, you really get out of it what you need. It's not just about giving them [out] to play on an app or something. (W, T3)

Conclusion

This paper has illustrated how the intuitive and easy to use nature of the iPad acts as a critical factor in enabling teachers and pupils to co-construct their skills in a fashion which is non-linear, playful and experiential. Despite their growing popularity and use in schools, there is little research or understanding to illustrate how teachers learn to use this potentially transformational tool. This study is, therefore, highly significant since it examines how primary school teachers in two countries learn to use the iPad, so resulting in an original model of professional development which has applications both in primary schools and teacher training institutions.

References

Attard, C. 2013. "Teaching with Technology: iPads and Primary Mathematics." Australian Primary Mathematics Classroom 18 (4): 38–40.

Aubusson, P., S. Schuck, and K. Burden. 2009. "Mobile Learning for Teacher Professional Learning: Benefits, Obstacles and Issues." ALT-J 17 (3): 233–247.10.1080/09687760903247641

Beauchamp, G. 2004. "Teacher Use of the Interactive Whiteboard in Primary Schools: Towards an Effective Transition Framework." Technology, Pedagogy and Education 13 (3): 327–348.10.1080/14759390400200186

Beauchamp, G., L. Clarke, M. Hulme, and J. Murray. in press. "Teacher Education in the United Kingdom Post Devolution: Convergences and Divergences." Oxford Review of Education.

Beauchamp, G., and E. Hillier. 2014. An Evaluation of iPad Implementation Across a Network of Primary Schools in Cardiff. Cardiff: Cardiff Metropolitan University.

Beauchamp, G., and S. Kennewell. 2010. "Interactivity in the Classroom and its Impact on Learning." Computers and Education 54: 759–766.

Beauchamp, G., and S. Kennewell. 2013. "Transition in Pedagogical Orchestration Using the Interactive Whiteboard." Education and Information Technologies 18 (2): 179–191.10.1007/s10639-012-9230-z

Burden, K. 2010. "Conceptualising Teachers' Professional Learning with Web 2.0." Campus-Wide Information Systems 27 (3): 148–161.10.1108/10650741011054456

Burden, K. 2013. "Crossing the Transformation Horizon: Conceptualizing Teachers' Learning and Transformations with the Affordances of Web 2.0." Unpublished PhD diss., University of Hull, UK.

Burden, K., P. Hopkins, and J. Pike. 2010. "Identity and Professional Learning with Mobile Technologies: A Case Study of Trainee and Newly Qualified Teachers." Proceedings of the 9th World Conference on Mobile and Contextual Learning, Valletta, Malta, October 19–22.

Burden, K., P. Hopkins, M. Stewart, T. Male, and C. Trala. 2012. iPad Scotland Evaluation Report. University of Hull. https://www.academia.edu/3795954/iPad_Scotland_Evaluation_2012_.

Burden, K., and D. Maher. 2014. "Mobile Technologies and Authentic Learning in the Primary School Classroom." In Teaching with ICT in the Primary School, edited by S. Younie, M. Leask, and K. Burden, 171–183. London: Routledge.

Clark, W., and R. Luckin. 2013. What the Research Says: iPads in the Classroom. London: London Knowledge Lab, Institute of Education.

Cutrim Schmid, E., and S. Whyte. 2012. "Interactive Whiteboards in State School Settings: Teacher Responses to Socio-constructivist Hegemonies." Language Learning and Technology 16 (2): 65–86.

Davis, F. D. 1989. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology." MIS Quarterly 13 (3): 319–340.

Ertmer, P. A. 2005. "Teacher Pedagogical Beliefs: The Final Frontier in Our Quest for Technology Integration?" Educational Technology Research and Development 53 (4): 25–39.10.1007/BF02504683

Fisher, T., C. Higgins, and A. Loveless. 2006. Teachers Learning with Digital Technologies. Bristol: FutureLab. Accessed January 1, 2015. http://archive.futurelab.org.uk/resources/publications-reports-articles/literature-reviews/Literature-Review129

Flewitt, R., N. Kucirkova, and D. Messer. 2014. "Touching the Virtual, Touching the Real: iPads and Enabling Literacy for Students Experiencing Disability." Australian Journal of Language and Literacy 37 (2): 107–116.

Fullan, M., and A. Hargreaves. 1992. "Teacher Development and Educational Change." In Teacher Development and Educational Change, edited by M. Fullan and A. Hargreaves, 1–9. London: Falmer.

Gabarre, C., S. Gabarre, R. Din, P. Shah, and A. Karim. 2014. "iPads in the Foreign Language Classroom: A Learner's Perspective." Southeast Asian Journal of English Language Studies 20 (1): 115–127.

Gibson, J. J. 1979. The Ecological Approach to Visual Perception. Boston, MA: Houghton Mifflin.

Greene, M. 2000. Releasing the Imagination: Essays on Education, the Arts, and Social Change. San Francisco: Jossey-Bass.

Greiff, S., S. Wüstenberg, D. V. Holt, F. Goldhammer, and J. Funke. 2013. "Computer-based Assessment of Complex Problem Solving: Concept, Implementation, and Application." Educational Technology Research and Development 61 (3): 407–421.10.1007/s11423-013-9301-x

Harland, J., and K. Kinder. 1997. "Teachers' Continuing Professional Development: Framing a Model of Outcomes." British Journal of In-service Education 23 (1): 71–84.

Heinrich, P. 2012. The iPad as a Tool for Education: A Study of the Introduction of iPads at Longfield Academy, Kent. Nottingham: NAACE: The ICT Association.

Henderson, S., and J. Yeow. 2012. "iPad in Education a Case Study of iPad Adoption and Use in a Primary School." HICSS '12 Proceedings of the 2012 45th Hawaii International Conference on System Sciences, 78–87.

Hixon, E., and J. Buckenmeyer. 2009. "Revisiting Technology Integration in Schools: Implications for Professional Development." Computers in the Schools 26 (2): 130–146.10.1080/07380560902906070

Howard, J., V. Phu, and V. Lan. 2012. "How Do Undergraduate Students Use Their iPad?" Journal of Technology Integration in the Classroom 4 (3): 5–12.

Huang, S. H., N. Clark, and W. Wedel. 2013. "The Use of an iPad to Promote Kindergartners' Alphabet Recognition and Letter Sound Correspondence." Practically Primary: Australian Literacy Educator's Association.

Hutchison, A., B. Beschorner, and D. Schmidt-Crawford. 2012. "Exploring the Use of the iPad for Literacy Learning." The Reading Teacher 66 (1): 15–23.10.1002/trtr.2012.66.issue-1

Johnson, L., A. Levine, and R. Smith. 2009. The 2009 Horizon Report. Austin, TX: The New Media Consortium.

Joyce, B., and B. Showers. 1980. "Improving Inservice Training: The Messages of Research." Educational Leadership 37 (5): 379–385.

Kearney, M., and D. Maher. 2013. "Mobile Learning in Math Teacher Education: Using iPads to Support Pre-service Teachers' Professional Development." Australian Educational Computing 27 (3): 76–84.

Kearney, M., S. Schuck, K. Burden, and P. Aubusson. 2012. "Viewing Mobile Learning from a Pedagogical Perspective." Research in Learning Technology 20. Accessed February 15. http://www.researchinlearningtechnology.net/index.php/rlt/article/view/14406

Kearney, M., K. Burden, and R. Taipan. 2015. "Investigating Teachers' Adoption of Signature Mobile Pedagogies." Computers & Education 80: 48–57.

Kershner, R., N. Mercer, P. Warwick, and J. Kleine Staarman. 2010. "Can the Interactive Whiteboard Support Young Children's Collaborative Communication and Thinking in Classroom Science Activities?" International Journal of Computer-Supported Collaborative Learning 5: 359–383.10.1007/s11412-010-9096-2

Male, T., and K. Burden. 2014. "Access Denied? Twenty-first-century Technology in Schools." Technology, Pedagogy and Education 23 (4): 423–437.10.1080/1475939X.2013.864697

Mishra, P., and M. Koehler. 2006. "Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge." Teachers College Record 108 (6): 1017–1054.10.1111/tcre.2006.108.issue-6

Murdock, L., J. Ganz, and J. Crittendon. 2013. "Use of an iPad Play Story to Increase Play Dialogue of Preschoolers with Autism Spectrum Disorders." Journal of Autism and Developmental Disorders 43 (9): 2174–2189.10.1007/s10803-013-1770-6

Murphy, G. D. 2011. "Post-PC Devices: A Summary of Early iPad Technology Adoption in Tertiary Environments." E-Journal of Business Education and Scholarship of Teaching 5 (1): 18–32.

Naismith, L., P. Lonsdale, G. Vavoula, and M. Sharples. 2004. Literature Review in Mobile Technologies and Learning. Bristol: Futurelab.

Northrop, L., and E. Killeen. 2013. "A Framework for Using iPads to Build Early Literacy Skills." The Reading Teacher 66 (7): 531–537.10.1002/trtr.2013.66.issue-7

Pegrum, M., C. Howitt, and M. Striepe. 2013. "Learning to Take the Tablet: How Pre-service Teachers Use iPads to Facilitate Their Learning." Australasian Journal of Educational Technology 29 (4): 464–479.

Peluso, Deanna C. C. 2012. "The Fast-paced iPad Revolution: Can Educators Stay up to Date and Relevant About These Ubiquitous Devices?" British Journal of Educational Technology 43 (4): E125–E127.10.1111/j.1467-8535.2012.01310.x

Peng, H., Y. Su, C. Chou, and C. Tsai. 2009. "Ubiquitous Knowledge Construction: Mobile Learning Re-defined and a Conceptual Framework." Innovations in Education and Teaching International 46 (2): 171–183.10.1080/14703290902843828

Puentedura, R. 2014. Learning, Technology and the SAMR Model: Goals, Practices and Processes. Accessed January 1, 2015. http://www.hippasus.com/rrpweblog/archives/2014/06/29/LearningTechnologySAMRModel.pdf

Simpson, A., M. Walsh, and J. Rowsell. 2013. "The Digital Reading Path: Researching Modes and Multidirectionality with iPads." Literacy 47 (3): 123–130.10.1111/lit.12009

Tearle, P. 2003. "Enabling Teachers to Use Information and Communications Technology for Teaching and Learning Through Professional Development: Influential Factors." Teacher Development 7 (3): 457–472.10.1080/13664530300200222

Van Laer, S., G. Beauchamp, and J. Colpaert. 2014. "Teacher Use of the Interactive Whiteboards in Flemish Secondary Education – Mapping Against a Transition Framework." Education and Information Technologies 19 (2): 409–423.

Webb, M. 2005. "Affordances of ICT in Science Learning: Implications for an Integrated Pedagogy." International Journal of Science Education 27 (6): 705–735.10.1080/09500690500038520

Williams, R., R. Karousou, and J. Mackness. 2011. "Emergent Learning and Learning Ecologies in Web 2.0." International Review of Research in Open and Distance Learning 12 (3): 39–59.

Zhao, Y. 2013. "Professional Learning Community and College English Teachers' Professional Development." Journal of Language Teaching and Research 4 (6): 1365–1370.

Zijian, G., and J. Wallace. 2012. "A Comparative Analysis of iPad and Other M-learning Technologies: Exploring Students' View of Adoption, Potentials, and Challenges." Journal of Literacy and Technology 13 (2): 2–29.