

The use of Web 2.0 technology for pre-service teacher learning in science education

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Abstract

This research explores the use of Web 2.0 in pre-service teachers' professional learning. A class of secondary school student science teachers in England were given two tasks to complete using a Web 2.0 collaborative online application. Their work is evaluated, as well as their comments about the use of the technology. Current trends and practices surrounding the use of Web 2.0 technology and mobile/tablet devices for learning and teaching are also discussed.

Keywords: Web 2.0, pre-service teachers, Initial Teacher Education, science teaching

Introduction

As the use of Web 2.0 rapidly permeates through industry, it is essential that jobseekers have an understanding of these new tools and how they may be applied to their work situation. In addition to this, these new tools are seen by some as offering important pedagogic benefits in the classroom as part of face2face delivery as well as for online distance learning. There is a growing body of research evidence showing the importance of teacher educators adopting Web 2.0 tools with pre-service teachers. For example, Albion suggests that teacher educators have a dual challenge of applying Web 2.0 in ways that will enhance learning opportunities for teachers in preparation as well as preparing them to work effectively with it in their own classrooms (Albion 2008: 183). Equally, Kidd states, 'It would seem clear that provision for pre-service teachers' learning be centred on encouraging the deployment of new technologies as a key part of their future pedagogy' (Kidd 2013: 261). He goes on to say, 'To move e-learning craft practices forward, we need to support teachers' professional development to learn about, learn how and learn through new technological forms' (Kidd 2013: 262).

What is Web 2.0 technology?

In The Cambridge Online Dictionary, Web 2.0 is defined as:

'A name for all the internet features and websites that allow users to create, change, and share internet content.' ("Cambridge Dictionary Online" 2013)

Examples of Web 2.0 tools are very familiar to many, due to the seemingly ubiquitous adoption of such tools for entertainment and personal communication: YouTube, Skype, Facebook, Google Docs, Word Press, Blogger, Wikipedia and Padlet (formerly Wallwisher). Whereas Web 1.0 technology is characterised by one-way communication, such as just reading a web page or viewing an image. Web 2.0 allows us to interact with the contents of the web such as leaving comments, live text, audio or video discussions. It enables content to be shared in a small group or across the whole world in real time and enables two-way communication. A particularly important facet of Web 2.0 is the cloud application. An application does not need to be installed on any device, but operates instead through a web browser and an internet connection. Many cloud applications such as Google Docs are free.

For educators these new developments have significant advantages. Firstly, the same application can be accessed on many different devices (smartphones, tablets, netbooks, etc). Secondly, they are accessible from any computer anywhere in the world. Thirdly many are free to use. Fourthly, they require lower-specification hardware, as the application is not run locally and so internet devices become cheaper. Lastly, html is the common language of the internet and unites all the different devices. Any application written in html is almost certain to run on all devices that have an up-to-date web browser.

There are now many Web 2.0 word processors, presentation applications, spreadsheets, etc, which can run on all devices without installing anything or

paying for them. As a result, technological barriers to using computers are reduced, collaboration and research becomes easier to implement, costs spiral downwards. This makes the landscape of Web 2.0 tools, and in particular the use of mobile/tablet devices, now a real pedagogic possibility for use in classrooms and outside formal face2face teaching. As a result, they also become an opportunity for the professional learning and training of pre-service teachers.

The need to learn it

A concluding Ofsted report, *ICT in schools 2008–11*, found that 'nearly half of the secondary schools surveyed were not meeting the needs of all students to prepare them for higher education and for skilled work'. The report goes on to say that:

'Teachers in both primary and secondary schools need more support and professional development to improve their confidence and expertise.' ('Ofsted ICT' 2013)

In the classroom both at university and at school, Web 2.0 has been shown to have benefits.

'Evidence demonstrates that Web 2.0 technologies improve teaching and learning. Maximizing learning involves thorough pre-planning through content creation and curation and establishing rewards for electronic interaction.' (Okoro et al. 2012)

Lankshear et al. (2000) explain the importance of teacher trainers getting real world experience of Web 2.0 in order for them to draw on their own experiences to design classroom activities (cited in Albion 2008: 193). Albion (2008) concludes, 'Hence, the best approach to helping teachers learn about Web 2.0 may well be to have them learn with Web 2.0' (Albion 2008: 193).

A recent research presentation by Natalie Pareja Roblin (ISATT 2013) exploring the use of tablets in the classroom concludes that 'access to (suitable) apps and integration with course content (TPACK) are perceived as major challenges for integrating tablets'. Accordingly, it is suggested: 'help teachers see and understand the ways in which tablets can be used to facilitate teaching and learning? – inspire and challenge long held routines and beliefs?' (Pareja Roblin et al. 2013).

Web 2.0 coupled with a tablet computer can help reduce the 'digital divide' between those with and

without computer access. The cheapest UK-sourced tablet computer is around £27 ('ICOO 7' 2013) which is comparable to the price of a good scientific calculator. In addition, no paid-for applications are needed on this device. In my own teaching experience, some schools expect pupils to have Microsoft Office, which not only costs several times more than a tablet but necessitates the use of an expensive PC to use it. In addition, most smartphones have web browsers able to support Web 2.0 applications.

The difficulty in getting ICT into schools

In one assignment set to our pre-service teachers, on emerging technology and its use in the classroom, it was interesting to note the number of trainees who actually applied new technology in their own classes. It was around the 20% mark. Clearly there are issues in applying new technology in the school setting that are not apparent in a university setting.

Somekh (2004) discusses the 'Institutionalised Resistance to the Radical Changes Made Possible by ICTs' in schools:

'It is not difficult to argue that every single one of the features of the Internet and ICTs more generally listed in the previous paragraph is antipathetic to the culture and traditional values of schools.' (Somekh 2004: 170)

Somekh goes on to explain other constraints placed upon pupils, particularly on access to the internet with its 'real but relatively small dangers' (Somekh 2004: 173). Some schools will block certain websites or prevent internet access altogether due to e-safety issues such as grooming or bullying. However, in my own teaching at a secondary school, I found the school welcomed and praised the implementation of new technology, but that most teachers were not up to date with the latest developments.

Web 2.0 in the classroom

A little of Web 2.0 in the classroom could save a lot of time. The following example is from my own Year 7 science class. They were set a homework task to make a short video on how particles are arranged in gases and liquids. The majority of videos came on USB sticks, and around 20% of the videos would not work as they were saved in formats not able to be opened by the class PC. It was very time-consuming to load the USBs into the computer. There were also problems reading Mac USB keys. It was time-consuming to show the class the different videos,

which had to be copied. One pupil had uploaded his video to YouTube and sent the link. This was by far the most efficient way of getting and viewing and it could have saved at least an extra hour if all pupils had used this method. The same problems can occur for pupils presenting PowerPoint slides. Web-based presentation products such as Zoho Show and Google Slides can be much easier to display in class.

What are the trends in computing and how do they affect teachers?

At the time of writing, the biggest-selling laptop in amazon.com is not a Windows PC but the Google Chromebook ('Amazon Best Sellers: Best Laptop Computers' 2013). The Chromebook represents a very different way of working to the PC or the Mac. The file system for Google Docs is completely different; no applications are installed locally, everything resides in the cloud. Its core operating system is Linux. It is inexpensive. It relies totally on the internet Web 2.0 technology. In this brief and anecdotal comment we can nonetheless see that there is also a massive trend towards tablet computing. Vaughan-Nichols writing in ZDnet comments:

'The computer landscape has undergone a dramatic transformation over the last decade with consumers responsible for the massive market realignment. While PCs were the primary Internet connected device in 2000 (139mn shipped that year), today they represent just 29% of all Internet connected devices (1.2bn devices to ship in 2012), while smartphones and tablets comprise 66% of the total. Further, although Microsoft was the leading OS provider for computer devices in 2000 at 97% share, today the consumer computer market (1.07bn devices) is led by Android at 42% share, followed by Apple at 24%, Microsoft at 20% and other vendors at 14%'. (Vaughan-Nichols 2013)

Android is a Linux-based operating system and there are other Linux OS's in the pipeline. Samsung is due to launch several high-end smartphones in September 2013 using the Tizen operating system, also Linux-based (Lee 2013). Mozilla have just launched a smartphone in the UK using their own Firefox OS for £59 'Pay as You Go' ('Firefox OS' 2013), and Ubuntu ('Ubuntu Phones' 2013) are about to launch smartphones and tablets. These latter new OS's may well be cheaper due to the patent litigation currently affecting Android. In a recent study, Android apps have also proven to be ten times more stable than Apple's iOS apps (Kamakashi 2013). Also, arguably

these Linux-based OS's are more versatile as they are able to run flash applications which iOS apps cannot (by default) and they are able to use the Mozilla Firefox web browser which is not available for iOS. A recent project on the use of low-cost £50 Android tablets in an English primary school have proved very positive ('Budget Tablets in Education' 2013).

The above trends could have a dramatic effect on teaching. Until now, the justification for having computers in the classroom has been pedagogy. Price will now play a significant part. Android tablets can be obtained for around £27 or less ('ICOO 7' 2013), whereas the iPad Mini costs in the region of £270 ('Apple iPad Mini', 2013). One science department I visited was spending £16,000 a year on paper and photocopying for 1,500 pupils. Couple this with a huge saving in textbook costs, calculator and organiser costs and it could take as little as a day to recoup the cost of a Linux-based tablet.

What is Padlet?

During my time as a secondary school science teacher, I came to appreciate the use of a 'Wall' as a means of communicating good practice. Every month we had continuing professional development (CPD) sessions after school. During these sessions we worked on tasks in groups of about four or five and would create either Post-it notes which would be pinned to a 'Wall' or A3 posters with our brainstorming ideas on them. For the next month we would see everyone's contributions, which would be pinned to the noticeboard in the staff room. The topics were on such things as starters and plenaries, differentiation, classroom teaching ideas, etc. After a month the posts would be taken down.

A Web 2.0 technology application such as Padlet can be used in a similar way to create a virtual wall, but with some significant advantages. It works across the world on virtually any internet-enabled device. It has permanence: the 'Walls' can be kept and can be copied. Multimedia files and documents can be posted. It can be used on a simple task such as starters and plenaries or could be used to run an entire lesson. It needs no special training and it is free. It can be used for collaborative projects such as starters, plenaries, differentiation, quizzes.

The Padlet blog describes how it can be used to run a complete classroom session ('Padlet Blog' 2013). Their website describes the following uses: teaching, noticeboards, bookmarking, discussions, brainstorming, note taking, quizzes, planning events,

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making lists, watching videos and collecting feedback. A gallery of walls is also available for viewing ('Padlet Gallery' 2013).

Using Padlet at UEL

Method

There were two tasks set which were designed to evaluate the use of Padlet for pre-service teachers of a class of 40. Each of these took place during a one-and-a-half-hour session at the university, the first session in late September, the second in February. At the end of the second session, students were asked to evaluate the use of Padlet by submitting an online form. The form was designed using Google forms and used a standard template. Students were given two minutes of training on how to post to Padlet. For this task Padlet did not require an account set up by the students. The first session was on the topic of the new Teaching Standards, Standard 1 ('Teachers Standards' 2013): 'Set high expectations which inspire, challenge and motivate pupils.' As part of the lecture, one of their tasks was to post their answer to this question on Padlet: 'Why should teachers set high expectations?' Students were set in groups of three or four and given half an hour to complete the task using university computers or their own tablets/laptops. They were given a worksheet with the task

details and the link to Padlet. They then returned to the lecture room where the Padlet 'Wall' was displayed on the whiteboard and discussed.

The second session was on the topic of SEND and the task was to post on Padlet their answers to the question, 'List 5 different strategies to support pupils with Special Educational Needs and Disabilities? Give a link to one useful resource for answering this question.' The same routine was followed as in their first session but with the added task of evaluating the use of Padlet using an online form.

The result of the task set

Below are the screenshots of the two tasks. These were displayed to the class at the end of the session and discussed.

Note that there are scroll bars on the 'Wall'. The wall can be of any size and can contain any number of posts; the scroll bars enable navigation to different parts of the board. The boards update in real time, therefore as the students are typing they see each other's boards instantaneously, no matter how far the computers are separated. These walls are public and require no account or login.

Figure 1. Screenshot of the Teaching Standards 'Wall'

The screenshot shows a Padlet wall titled 'TEACHERS' STANDARDS IN ENGLAND FROM SEPTEMBER 2012' under 'Development Task 1'. The wall has a green background and contains numerous student posts. Some visible posts include:

- alan**: Why should teachers set high expectations?
- Diarmuid**: You should strive to raise the bar for your students. If you expect less effort you will receive less effort.
- "Deirdre"**: You should work on an attitude that says that know students can achieve to your level of expectations, thereby giving them a sense of confidence too.
- Faisal**: Bcoz they hav 2
- "Anonymous"**: Because they should expect their pupils to have high standards.
- "Anonymous"**: To enable pupils to achieve and progress to the best of their ability
- Mike**: If you don't who will?
- "CMS"**: Encouraging High expectations should be set by teachers to inspire and encourage students to 'reach their potential'
- "CMS"**: Without high expectations, there is a risk of pupils becoming demotivated, uninterested and disengaged
- Lucy**: Giving the students a high level of expectation elives
- "UZAIR"**: To be able to set high expectations, teachers need to be able to be good role models, as this is the only way the students will respect them.
- "Alia.M"**: To INSPIRE, MOTIVATE, and CHALLENGE pupils.
- Rosie**: "when teachers believe in students, students believe in themselves"
- Iain**: Because children of all abilities can, and need to be, pushed to reach their full potential.
- Andrae**: The expectations teachers have for their students and the assumptions they make about their potential have a tangible effect on student achievement.
- Anonymous**: Alan is awesome!

Figure 2. Screenshot of the SEND 'Wall'

The screenshot shows a Padlet wall titled "SEND". The wall has several pinned notes:

- Paul**: Try to sit pupil beside others who are good role models.
- Ossama**: For students with Visual Impairment: Provide photos, large text, scrapbooks, check for certain students.
- Murat & Isma**: too much w. Visually Impaired Pup.
- EramAshaUz**: Provide additional worksheets with less text. Give them extra time to complete the work.
- Suzanne**: Use images and ph writing skeletons. Direct Learning staff.
- Rosie and Lucy**: 1) Be flexible with planning ready to minute. 2) For All Objective visual cu.
- Athar, George, Sair Yvonne, Dyma**: Dyslexia: Larger text over lay.
- Dyma - Yvonne**: Visually impaired: Using images as equipment.
- Laura and Mery**: Work with your them in planner.
- Samuel Bar**: For a pupil 1. The child away from windows w. be distract should be c hear and se given by th sheets with answers to amount of 4) Autis of social kids may h with Aut.
- Bradley**: Large text for dyslexia. Using Larger Text.
- Physical**: Physical difficulties.
- ADHD**: ADHD
- Scrapbook**: Scrapbook with audio.
- Afreedah and Azmina**: Keyboards with Bigger Keys.
- Seating plan**: need accomodate SEN pup.
- Adwin - Street Hall /**
- DED**: Text to speech software for visually impaired pupils.
- Samuel Bar**: Larger font for visually impaired pupils. Braille keyboards. Working with TA's to s SEN pupils. Differentiation of work. Resources: <http://scotens.org/>.

This made for rapid implementation in class, requiring only two minutes of instruction. It is possible to set it privately. All students were able to post to the wall. The only difficulty was with one out-of-date internet browser on a college computer. From the second screen shot we can see hyperlinks referencing other resources which can be instantly accessed by all the other class members, especially as the users are already on the internet. This activity would also have been very suitable for the traditional Post-it note. It involves peer collaboration and peer reviewing. Students are able to discuss and view each other's answers and so generate a wider understanding of the issues. Padlet adds the advantage of permanence. The wall is available to view at a later stage and on many different devices. Another advantage is introducing students to a new and fun technology. The majority of students found the use of Padlet beneficial for the task set.

The result of the task set

The students' evaluations of Padlet were collected using Google Forms. This is a free web application available with a Google account. The form is easy to use, comes with several templates and would be easy to implement for collecting online homework. Students submitted the form online after their second task in their groups of three. The results appeared in

my Google account as data in a spreadsheet. There were ten questions in all.

Results of the survey

Below are the ten questions with a summary of the results. There are a maximum of 13 responses per question.

Is this technology beneficial for the activity given in your lecture?

All respondents thought the technology was beneficial to the task.

Why do you consider it to be beneficial or not beneficial?

Some typical responses:

'We can all work in groups but share our findings instantaneously. It is great for sharing ideas and being able to see what the other groups are doing.'

'Allows us to share our opinion, whilst also giving us the opportunity to see what others think about the topic.'

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'The Wallwisher allows the transfer of information between pupils, this assists collaborative learning. This is very beneficial as peer support is vital for an effective progression through the course.'

Would you like to use it in your own teaching?

Of the 13 student groups, 12 said they would use this technology in their own teaching.

What different activities might you use it for?

'Brainstorm activities if the class were in a computer room.'

'I would use it to help engage SEN and EAL (Google translator) students.'

'Can be used as an interactive plenary, or as a form of assessment, or could be used a forum for debate within a class / for homework.'

'For group work activities, it will help pupils to share ideas and view each other's comments.'

'I think it would be useful to use with higher KS students or A Level students.'

'It would be very useful for revision as students could post important terms, definitions and formulas to help their peers.'

Is it easy to use?

All respondents found it easy to use.

Does it have a use other than for teaching?

'Yes I have seen it on websites where people can leave comments and feedback.'

'As a method of assessment'

'Could use for departmental / schools notes, or to post notes on specific classes or individuals so that teachers can be instantly updated on issues for student they may have later that day.'

'Definitely, it is basically a message board'

Can you think of any activities which it would be useful for in UEL sessions?

'To discuss topics which summarise learning and to evaluate modules / lectures etc.'

'When we are asked to do group work and present our feedback.'

Did you find it fun to use?

Of 13 respondents, 11 found it fun to use. One group said no, owing to the fact it kept on freezing. This was later found to be owing to the use of an outdated internet browser. One group reported on the difficulty of reading overlapping posts. This could be alleviated by choosing different layouts for the Padlet Wall (an option in the layout menu).

Are you currently using any cloud applications? Which ones?

Of 13 respondents, 7 are not using any cloud applications. Those being used are: Dropbox, sugarsync, a school learning gateway.

Discussion of results

These results confirm the benefit of exposing pre-service teachers to Web 2.0 technology. They are able to see uses and advantages for it in a classroom setting as well having a clearer idea of how it they themselves could implement a range of learning tasks. This supports Lankshear et al. (2000) who explain the need for pre-service teachers to get real-world experience in order to design classroom activities. (cited in Albion 2008: 193). It also agrees with Albion's conclusion, 'Hence, the best approach to helping teachers learn about Web 2.0 may well be to have them learn with Web 2.0' (Albion 2008: 193).

Almost all students thought that not only was the use of Web 2.0 beneficial to the task set but that it was fun to use as well. This is in agreement with the mounting evidence that 'Web 2.0 technologies improve teaching and learning' (Okoro et al. 2012).

Discussion of results

It would seem inevitable that sooner or later schools will adopt tablets or PCs to replace paper and/or textbooks. This may happen because of pedagogy but more probably because of price. With powerful Android tablets now available for less than £30 ('ICOO 7' 2013), there becomes a cogent reason for investing

in this new technology. It is therefore necessary that tomorrow's teacher be able to deliver lessons in or out of class across all devices using the latest Web 2.0 applications. For many pre-service teachers, Web 2.0 can be a different and unknown way of working and it is therefore essential to expose them to this technology.

Padlet is typical of many Web 2.0 applications. It is free, does not require any application to be installed, is easy to use without training, is interactive and can be viewed and collaborated on anywhere in the world – instantaneously. It can be used for a single task, such as starter and plenary activities, or could be used to deliver an entire lesson online or in the classroom complete with assessment, multimedia, and PowerPoint and Word files. By introducing it to pre-service teachers, they become familiar with a new way of working, are able to communicate across all operating systems and appreciate how it could be used in the classroom.

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