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LEARNER GENERATED CONTENT USING WEB 2.0 TECHNOLOGIES

Does the use of webtools and web technologies in the classroom have a positive impact on students' perceptions of their learning?

by

Christine Turner

Master's Thesis

Submitted in partial fulfilment of the requirements for the award of MPhil ICT in Teaching and Learning of Loughborough University

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Learner Generated Content using Web 2.0 Technologies

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ABSTRACT

Web 2.0 refers to the second generation of the World Wide Web and its associated technological improvements. Web 2.0 technologies are potentially very powerful tools. In this report, a thorough review of the literature concerning Web 2.0 technology is conducted. Web 2.0 is first defined and then the various webtools available for use in schools are investigated. The main types of technologies currently being used are summarised, opportunities for students to generate content are discussed and their successes are compared. The advantages of, and problems associated with, using Web 2.0 technologies in schools are explained, the factors which should be considered when using these tools in the classroom are then clarified and the policies and standards which relate to Web 2.0 technologies are explained.

This action research and case study based investigation was conducted into the use of certain Web 2.0 technologies in teaching and learning in one UK secondary school Science classroom, which broadly follows a constructivist paradigm and specifically focuses on opportunities for learners to generate their own web content. The Web 2.0 tools investigated included wikis, free online website generators, commercial packages, etherpads and corkboards. Main findings highlighted that overall, the students who participated in this study largely viewed the ICT tools and Web 2.0 tools they used as being beneficial to their learning, engagement and enjoyment of their science lessons. The researcher also reports an original contribution to the knowledge whereby Key Stage 5 students generated revision websites using a free website creation tool called Yola, to improve their subject knowledge, which they then shared with their peers.

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DECLARATION

I declare that this work is my own, except where referenced as otherwise.

Christine Turner

30 November, 2013

CHAPTER ONE

INTRODUCTION

1.1 Introduction

The development of ICT in schools has progressed rapidly over recent years. The British Educational Communications and Technology Agency (Becta) stated in 2007 that:

> *"The aspiration is that by 2010 all schools will have integrated learning and management systems. Schools and local authorities (LAs) should be planning towards this target that provides the full range of functionality across every aspect of school life. An intermediate target for 2008 is that all learners should have access to a personalised online learning space with the potential to support e-portfolios."*
>
> (Becta, 2007, p.2)

The academic year 2012-2013 saw that the use of computers and ICT in UK educational institutions, such as schools and colleges, was not only routine, but had been prescribed by the National Curriculum since 2007 (Department for Education, 2012). This was still the case in 2012; partly due to availability of computers, an increased familiarity with both ICT software and hardware amongst the learning community and the growing availability of high speed broadband Internet connections. In May, 2013, the Secretary of State for Education, Michael Gove, confirmed that the National Curriculum subject of Information and Communication Technology (ICT) was to be replaced by 'Computing', from September 2014 (Department for Education, 2013).

Also, in 2013, the programmes of study for ICT at Key Stages 3 and 4 were disapplied and were made no longer statutory. Although ICT remains a compulsory National Curriculum subject at all four Key Stages, revised Programmes of Study for ICT will come into force in September 2014. In 2007, when the above (Becta) statement was made, only 61% of households had Internet access, although the majority of these were broadband connections (Office for National Statistics Online, 2013). However, this figure rose to 70% in 2009 and 80% in 2012:

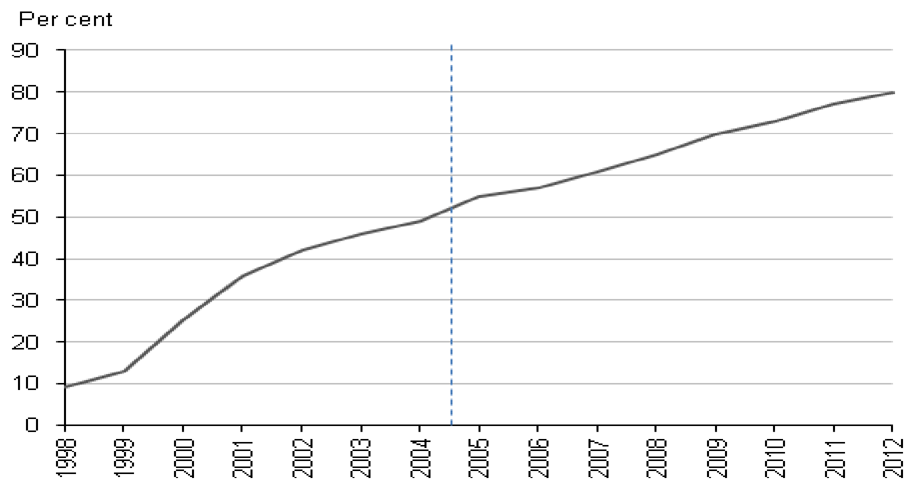

Figure 1.1: Households with Internet access (Office for National Statistics, 2012) Base: UK households from 1998 to 2004. Great Britain households from 2005 to 2012.

Similarly, 500 primary and secondary schools surveyed by Becta (Kitchen *et al.*, 2007) all indicated they had Internet access which seems to be in line with the national figure. For example 100% of Scottish secondary schools had Internet access as early as 2001 (Scottish Executive, 2003) which suggests that by 2007 it is likely that the majority of UK schools had Internet access.

As courses (such GCSE, AS, A2 and BTEC) are enhanced and developed so that students may personalise their learning by accessing course materials remotely, there is an expectation that Virtual Learning Environments (VLEs) will form a significant part of the next generation's experience of education. However, if an institution cannot afford, either in terms of time or finance, to implement a VLE or if an institution has invested time in a VLE, only to find that it is not available the following year, then teachers may then turn to the many Web 2.0 tools available for free via the Internet.

This has been the case in the researcher's school, which prompted this study. With this in mind, this thesis will only focus on the use of Webtools (software) and not hardware, as unfortunately this comes with a certain financial obligation. Also it is important to note that whilst there are numerous studies (for example Ajjan and Hartshorne, 2008; Chen *et al.*, 2008) focusing on examples of Web 2.0 technologies being utilised in higher educational settings, there is scant research in the secondary sector. Few examples of published research into Web 2.0 technologies in science teaching and learning could be found. This has been confirmed by others, for example:

> *"There have been many evaluations of individual courses, but few studies that examine online teaching and learning in a cross-institutional perspective, and in particular there are very few studies of teacher education and even fewer of science learning online. It is clearly important to understand the nature of learning in this increasingly widespread phenomenon, in order to inform the development of new courses and programs."*
>
> (Rowe and Asbell-Clarke, 2008, p.75)

Rowe and Asbell-Clarke (op. cit.) suggest that there is some possibility for contribution to the literature in the field of the use of webtools in secondary science education. Therefore, the central question to be addressed in this research is: What, if any, is the impact on the students' learning of the use of webtools in the secondary science classroom?

1.2 Context

The researcher, a Science Teacher at a secondary school and sixth form in an East Midlands city, at the time of this study, had been her current post for 8 years. Now well established in the school, the researcher wished to further her professional development and implement her learning in the classroom.

According to Ofsted (2009 and 2012), the school involved in this research had around 1050 students on roll at the time of this study, and drew its students from across the city and beyond its boundary. Students came from a wide range of different backgrounds. Most were White British, although almost one fifth were from other ethnic backgrounds, a higher proportion than was found nationally. The proportion of pupils entitled to Free School Meals (FSM) was below average and the proportion with learning difficulties or disabilities was in line with the national figure. The proportion of students with English as an Additional Language (EAL) was higher than nationally.

In terms of computing facilities, the school had 6 classrooms with between 20 and 30 computers in each, and the Library which had 18 computers. All rooms were able to be booked by staff for use with their classes, and this was dependent upon availability, as the rooms may be booked up to two weeks in advance, via an online booking facility. Students were able to book computers in the Library during break and lunch time and they were also able to use the library after school in homework club. The sixth form had a small computer room for their sole use, which was also located in the Library.

Despite this, in 2010, in the secondary science classrooms at the school involved in the study, the researcher observed that ICT was being used sparingly by teachers, other than for PowerPoint presentations. This was confirmed in discussion with colleagues. However, the researcher was proficient in the use of presentation software and many of her lessons involved students viewing PowerPoint slides, interacting with commercial packages such as Active Teach and watching multimedia clips on YouTube. It was noticed that most students in the teacher's classes generally enjoyed lessons involving ICT, frequently asking "are we going to the computer room today?" with hopeful expectation. Behaviour in lessons involving ICT was deemed by the researcher to be generally better than those without, with students appearing to be calmer and more focused on the task at hand.

Webtools, as a research area, had been of significance to the researcher since she attended a CPD course on the implementation of the Virtual Learning Environment (VLE) package, Fronter, within secondary schools in the City. After a few hours of investigation of the possible uses of Fronter the researcher felt assured of the potential teaching and learning benefits to both students and teachers, especially with regards to peer and self-assessment. Both the school and Local Authority were interested in adopting a common VLE and training its staff in its use, before it was fully implemented. Some schools in the city already had some experience with using VLEs such as Moodle. At the time, the researcher had very little knowledge of VLEs, so before the training, she conducted some initial research and attended several courses, to further her knowledge of Web 2.0 tools, with the ultimate aim of allowing her students to benefit from the change to her practice.

Fronter was then trialled by the teacher and used with her classes. She also ran Fronter training for the school teaching staff but, as it had not been rolled out successfully by the whole school, students were reluctant to use it and did not access the online resources regularly. The administration of the Fronter classrooms was time consuming and the teacher began to doubt its value as a teaching and learning tool.

The following year, due to high financial cost, it was announced the school would not be renewing its subscription to Fronter. However, following a visit to a nearby college, it became apparent that VLEs and webtools could be used very successfully. In fact, one school visited by the teacher stated that they owed their good AS and A2 grades to their free VLE, Moodle. Having already invested a significant amount of time into the VLE concept, but without financial support, the researcher then sought to create her own version using free webtools, but was unsure if her students would gain from using them as well.

It was therefore questioned if students perceived that they learned better when using ICT than when they used textbooks or more traditional learning methods. Specifically, the teacher wanted to find out if free webtools could be used to improve the students' perceptions of their learning, as many of the commercial packages available for teaching and learning cost the Department a significant amount of money each year. It was thought that if the teacher could become proficient in the development and use of a range of free webtools, students' learning would improve in the lessons in which they were used, as the students may be more focused and motivated by the technology. Twidle *et al*. (2005) found that this was the case in their study, stating:

> *"…having the opportunity to work on the internet was in itself a motivating factor for many pupils. However, it was recognised that this motivation could soon wane if care wasn't taken in the way tasks and sites were selected."* (p.9)

It was therefore essential that the tools and tasks were designed to minimise this issue and it was suggested that the teacher could customise the tools to fit the needs of each class. Furthermore, the researcher wondered if students would also learn more by creating their own virtual content.

1.3 Aims

In this section the research questions and the theoretical framework used to help understand and analyse the substantive topic relating to the central question are set out. The aim of this research is to find out whether, in science lessons, webtools can be used to help students learn. The website www.dictionary.com defines learning as *"The acquisition of knowledge or skills through experience, practice, or study, or by being taught."* However, this is a simple definition and in the literature, learning has been linked not only to knowledge and skills, but to both enjoyment and engagement. Chapman (2003) defined student engagement in association with classroom learning and stated that three criteria must be considered as part of a "learning task", these being the cognitive investment, active participation and emotional engagement of the student. In addition, Mitchell *et al.* (2005) found that in their study:

> *"There appear to be statistically significant relationships between levels of web enjoyment and students' attitudes toward the use of the web-based learning system. The students who had higher levels of enjoyment considered the tutorial to be more valuable"* (p.35).

Students' perceptions of their own learning may therefore extend past mere acquisition of knowledge and skills and they may perceive that they are learning, or learning more, when they are enjoying the lesson and they are engaged in a task, or they may view these aspects separately. The research questions postulated in this study, therefore, address these aspects both separately and together, and are as follows:

1. What are secondary school students' perceptions of using the following ICT based teaching tools: a. Commercial sites e.g. Kerboodle and b. Teacher generated course websites, in science lessons?
2. What are secondary school students' perceptions of using the following Web 2.0 tools: a. Wikis, b. Etherpads and c. Corkboards, in science lessons?
3. Do secondary school students perceive that Web 2.0 tools and ICT based teaching tools contribute positively to their: a. Learning, b. Enjoyment and c. Engagement, in science lessons?
4. Do Key Stage 5 students perceive that generating their own science content using: a. Wikis and b. Website generators, improves their learning?

1.4 Justification

When justifying the topic of the study, the researcher has sought to investigate an area which may have, initially, a positive effect on her teaching, and her students' learning, and ultimately may be able to influence school policy. Cohen *et al.* (2011) agree that this is a good approach, stating that:

> *"Research needs to…choose a significant topic that will actually make an important contribution to our understanding and practice." (*p.107*)*

and it is important therefore to:

> *"Identify what benefit the research will bring, and to whom, as this will help to focus the research and its audience." (*p.107*)*

The researcher believes that Web 2.0 technology is a significant topic. An investigation into this field could provide insights which may make a difference to teachers' practice. For several years, the researcher has noticed that the popular student response to the announcement that 'the lesson today will be in the computer room', is a resounding positive exclamation – the students generally appear to enjoy using information and communications technologies (ICT). However, there is some possibility that students see this as an easier option than doing "real" work, and this must be taken into consideration.

It is also evident that information and communication technologies have the potential to engage students' interest in science. Students are already familiar with the use of ICT, although they may have little experience of using these in an educational setting. The Office for National Statistics (2012) reported that, in the UK, 96% of children aged 10 to 15 years have a home computer and 90% of girls and 84% of boys own a mobile phone. The Office of National Statistics also stated (2012), that the 16 – 24 age group reported mobile phone Internet use above 80%, and 72% of 16-24 year olds reported accessing social networking websites or applications via a mobile phone. (Office for National Statistics, 2012). Previously in 2011, Ofcom suggested that even younger children may have access to a mobile phone, reporting that:

> *"…half (50%) of all children aged 5-15 have a mobile phone, and close to one in five (18%) parents of children aged 5-15 say their child has a smartphone. As with overall incidence of mobile phone ownership, the likelihood of owning a mobile phone increases with the age of the child, with just 3% of 5-7s owning a smartphone, around one in eight 8-11s (13%) and around one in three 12-15s (35%)."*
> (p.14)

If children are now digital technology 'natives' and enjoy using ICT at home, there exists a good possibility of engaging a class and influencing their learning using new ICT tools, for example webtools.

1.5 Issues

The broad issues associated with undertaking this research were as follows:

- Access – Did the researcher have access to participants and did the students and researcher have access to the ICT tools at the institution? It had been reported in one social science textbook that:

  > *"Gaining access to people and institutions is one of the most difficult tasks for an empirical researcher."*
  >
  > (Cohen *et al.,* 2011, p.108)

  This was likely to have been the biggest problem facing the researcher during this study. It was possible that the classes that the researcher taught were not suitable, or did not consent to participate in the research, so access to participants may have been limited. It was also likely that there were times when a computer room could not be booked for the webtools to be trialled, or that the school's network would not operate successfully. It was also possible that some or all of the webtools under investigation may have been blocked by external agencies during the period of data collection.

- Skills – Did the researcher have the necessary skills, disposition and perseverance to be able to conduct the research? Balancing a full time teaching career and a part time research project may have clearly become a challenge to the researcher during the course of the study. It was vital that the researcher have appropriate skills to be able to manage both effectively, whilst maintaining an appropriate disposition, in order to recruit participants. Students may have been less willing to participate in the research if they felt the researcher was not sustaining a healthy, professional relationship with both students and colleagues.

- Expertise in the field – Did the researcher have enough knowledge of the field to conduct the research? This was the main reason for conducting a literature review first. The researcher personally felt that her subject knowledge was adequate in the field of research and had been developed through a variety of CPD activities over the last five years, although any opportunities for further CPD were undertaken in order to support this knowledge.

- Time – Was the project manageable in the time available? This was the second largest problem to be faced by the researcher. The demands on this full time teacher's time were high and there were some anxieties that undertaking a large scale research project would not be able to be finished in the specified time frame. It was important here that the type of study was appropriate for the time available. One could not, for example, conduct a longitudinal study in 6 to 9 months. The research design must have been realistic and must have taken into account the fact that data were not able to be collected during the school holidays. It was also likely that large amounts of writing up and data analysis were not possible during term time. The project must have been able to be managed in accordance with these time limitations.

- Availability of the researcher and participants – Were the people involved in the research willing and able to give up their time to participate in the study? It was important that the classes or focus groups were available throughout the data collection period, and preferably for a short time afterwards, in case follow up questions were required. Was an appropriately sized sample able to be taken from these data? The researcher ensured that consent forms were given to all participants. It should have been anticipated that some participants may have refused to take part in the research or may have wished to withdraw their responses. How the consent form was phrased may have been crucial to the success of the research, and the researcher must have stressed to the participants that any data collected was to be stored securely, the participants' confidentiality was to be respected and the time commitment would be minimal.

- Resources – What human and material resources were required for the research to be undertaken? There would have been issues if, for example, a thousand paper-based questionnaires were needed to be printed but nobody was available to do this, or the cost of printing fell outside the budget of the researcher. Alternative methods of data collection may have been explored in such an event. Liaison with the school's Principal and Reprographics team was also essential.

- Change to practice – Did the research make any difference? If the outcomes produced little or no difference in practice, the point of the research would have become unclear. The research study therefore should have not ended after the data collection and appropriate opportunities for implementation of any recommendations to changes in practice should have been found.

- Was the scope of the research too wide and could it have been narrowed down if the project became unmanageable? If there was no room for manoeuvre, the research may not have been able to be narrowed down or may have lost focus and become unmanageable. The research questions were, therefore, constrained by the context of the science classroom and by the use of secondary or KS5 students as participants.

1.6 Hypothesis

It was hypothesised that students will have reported that they perceived that both commercial sites, like Kerboodle, and teacher-generated course websites had a positive impact on their learning. It was also thought that the secondary school students would perceive that Web 2.0 tools such as wikis, etherpads and corkboards helped them to learn in their science lessons. Linked to this was the hypothesis that secondary school students would say that Web 2.0 tools and ICT based teaching tools had contributed positively to their learning, enjoyment and engagement in their science lessons during this study. Furthermore, it was thought that Key Stage 5 students would perceive that generating their own science content using wikis and website generators improved their learning. The null hypothesis was that using these webtools had no effect on students' learning, enjoyment and engagement in science lessons; that they had no significant positive opinion about the use of these webtools, and that Key Stage 5 students did not perceive that generating their own science content using webtools had improved their learning.

1.7 Goals

As a result of this research, the researcher hoped to demonstrate the benefits of using webtools in teaching and learning. It was hoped that access to appropriate, co-operative teaching groups from which pupils could be randomly sampled, would allow for sufficient data to be collected to be able, with caution, to suggest whether webtools can improve students' perceptions of their learning, at least in this school. For this to be achieved, the researcher required that all ICT networks and peripherals were functioning correctly during the period of data collection, and this was hoped to be the case. If a link was made between the use of webtools and improved learning, engagement or enjoyment in lessons, the researcher hoped to then integrate the webtools investigated into her everyday science teaching, and those of her colleagues. If this was to be successful, the researcher needed to be able to demonstrate to the school's Senior Leadership Team how this could be done and the benefits of using webtools over or alongside current methods would have to be supported by quantitative data. As a personal goal, the researcher also hoped to be able to use the skills acquired through the undertaking of this research to progress in her career, using her webtools specialism to take a Science with ICT Advanced Skills Teacher, or equivalent position, at some point in the near future.

1.8 Thesis Structure

This thesis is structured in seven chapters. In the next chapter, a thorough review of the literature concerning the use of Web 2.0 tools is set out, to provide the research context. This includes information about what Web 2.0 tools are available and what are being used in schools. Chapter 3 explains the research design and methodologies and the theories and models used throughout this thesis are discussed. In chapter 4 the methods used in the field of study are explained. Chapter 5 sees the findings of the study presented in a series of tables and charts, and analysed. In chapter 6, the results are discussed with reference to the research questions. Finally, in chapter 7 the conclusions of this study are displayed accompanied with contributions and recommendations, and suggestions for further study. This is outlined in Figure 1.8 overleaf.

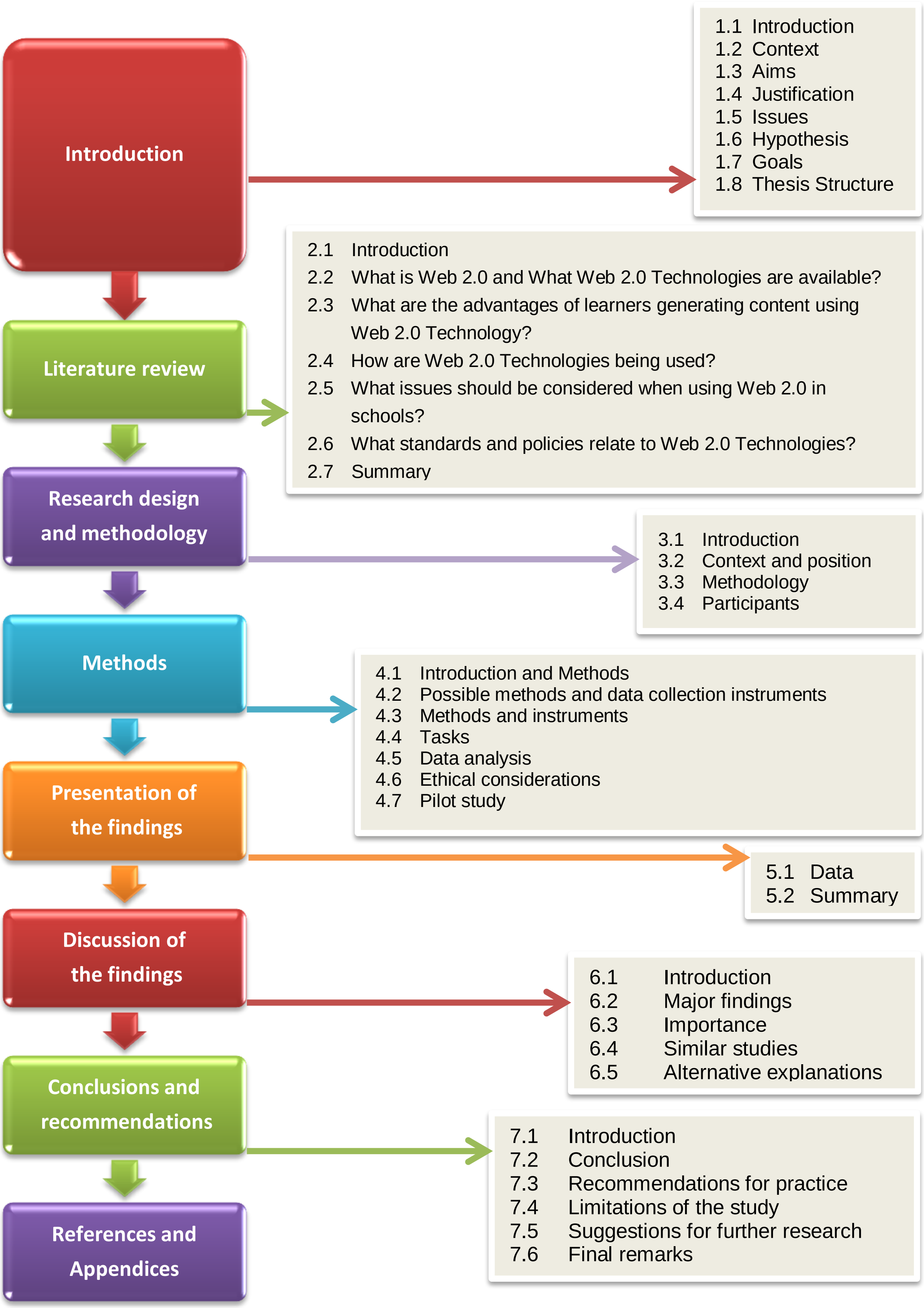

Figure 1.8: Thesis structure outline

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

As mentioned earlier, the use of ICT has been increasing both in schools and in everyday life. Similarly, this ICT has developed significantly and we have moved from a static to a dynamic World Wide Web. Webtools and technologies may have some benefit to learners. Hence, in this chapter, a comprehensive review of the literature with respect to Web 2.0 tools and technologies is presented, including an in depth discussion of what Web 2.0 technologies are available and how they are currently being used in schools by both educators and learners. An outline for the structure of this chapter can be seen in Figure 2.1 overleaf.

2.2 What is Web 2.0 and what Web 2.0 technologies are available?

- 2.2.1 User-generated Content
- 2.2.2 Blogs
- 2.2.3 Collaborative Editing Tools
- 2.2.4 Wikis
- 2.2.5 Websites
- 2.2.6 Forums
- 2.2.7 Content on VLEs
- 2.2.8 Podcasts, Vodcasts and Media Sharing
- 2.2.9 Other Webtools - Apps and Social Networks

2.3 What are the advantages of learners generating content using Web 2.0 Technology?

2.4 How are Web 2.0 Technologies being used?

- 2.4.1 Students' Social Use of Web 2.0 Technologies
- 2.4.2 The Current Situation in Secondary Schools
- 2.4.3 Blogs and Wikis
- 2.4.4 Collaborative Editing Tools, including Etherpads and free Website Generators
- 2.4.5 Forums
- 2.4.6 Content on VLEs
- 2.4.7 Podcasts, Vodcasts and Media Sharing
- 2.4.8 Other Webtools - Apps and Social Networks

2.5 What issues should be considered when using Web 2.0 in schools?

- 2.5.1 Teaching and Learning Issues
- 2.5.2 Time Issues
- 2.5.3 Institutions ICT Capabilities
- 2.5.4 Technical Issues and Technical Support
- 2.5.5 Staff Competencies when using Web 2.0 Technologies
- 2.5.6 Home Access
- 2.5.7 Financial Situation of Schools
- 2.5.8 Leadership, Training and Quality Assurance
- 2.5.9 E-safety, Filtering and Blocking
- 2.5.10 Development of the Infrastructure

2.6 What standards and policies relate to Web 2.0 Technologies?

2.7 Summary

Figure 2.1: Outline of the Literature Review

2.2 What is Web 2.0 and what Web 2.0 Technologies are available?

Web 2.0 is a term, introduced in 2004 by Tim O'Reilly and MediaLive International, which refers to the second generation of the World Wide Web and its associated technological improvements. As in common practice in technology, changes in applications are given decimalised number appendices, where the integer change denotes a major evolution in design or implementation, whereas a change to the decimal defines a smaller update. Thus Web 2.0 has been coined as it describes the step change to the already existent World Wide Web (Web 1.0), often now referred to as the read-write web, to indicate that a new 'version' exists in which users can make a difference to what the Internet 'does'. Web 2.0 technologies allow for greater participation and collaboration, using a range of widely available digital media formats. Figure 2.2 shows a timeline of some major developments in Web 2.0 technology:

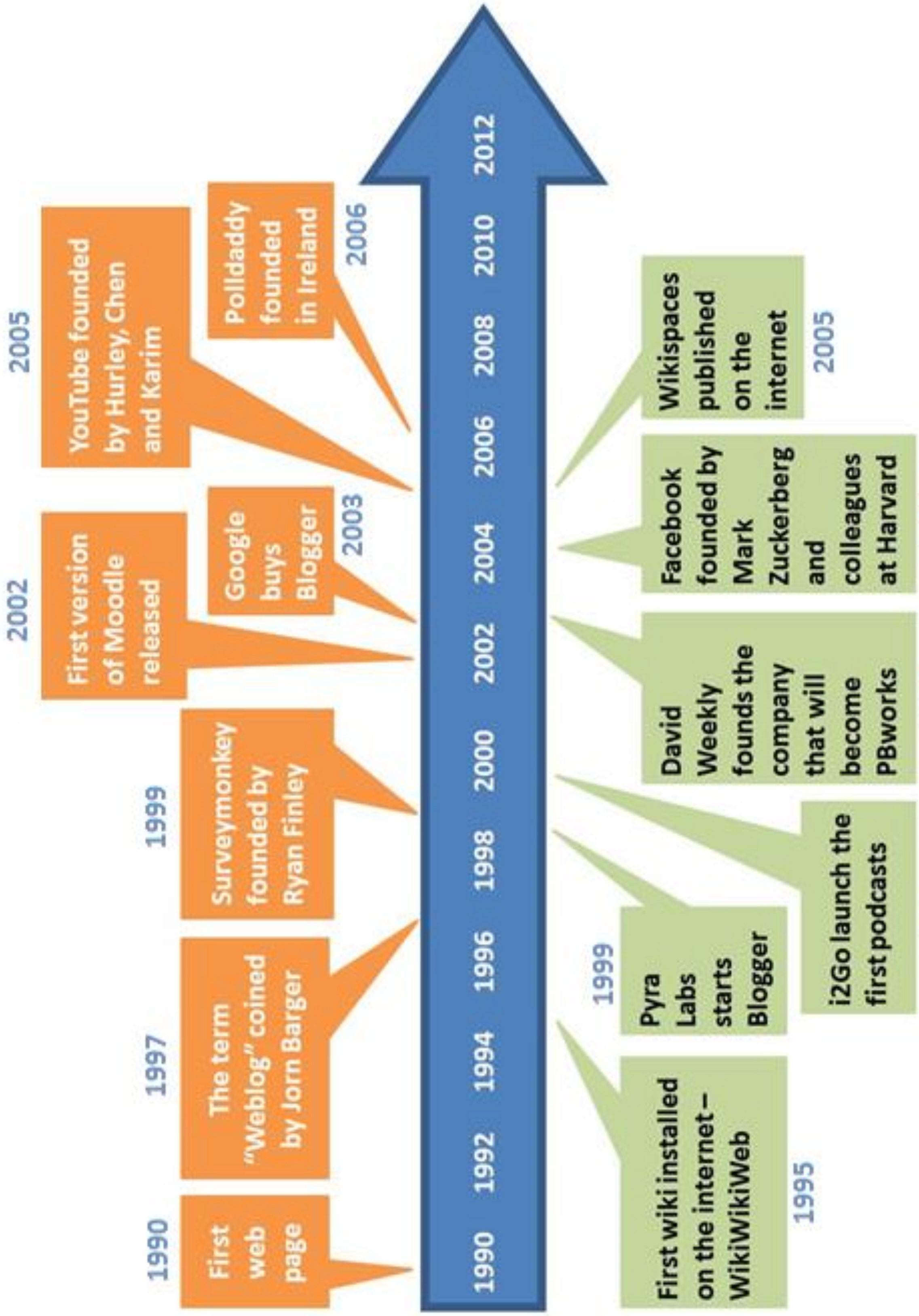

Figure 2.2: Timeline of Webtool development (See Appendix 4 for references)

Leadbeater (2008) comments:

> *"If we could persuade 1 per cent of Britain's pupils to be player-developers for education that would be 70,000 new sources of learning. But that would require us to see learning as something more like a computer game, something that is done peer-to-peer, without a traditional teacher. We are just at the start of exploring how we can be organised without the hierarchy of top-down organisations. There will be many false turns and failures. But there is also huge potential to create new stores of knowledge to the benefit of all, innovate more effectively, strengthen democracy and give more people the opportunity to make the most of their creativity."* (p.26)

Although this quotation is subjective, and from a national newspaper, the researcher felt that Leadbeater made an important point. Webtools have afforded users with the possibilities of interacting with wider communities to build and share content. As secondary school students make up a proportion of these users, there is potential for use of these technologies in an educational setting.

Many tools, such as wikis and blogs, are currently available on the Internet and may be already being used, to various extents, in schools and colleges (Crook *et al.,* 2008). Some, such as discussion forums and instant messaging, have been in use for several years in business and homes and often, these new technologies make use of existing services. The following sections will introduce these Web 2.0 technologies and review their availability. The Web 2.0 technologies discussed are blogs, collaborative text editors such as etherpads, wikis, free website generators, digital media sharing such as podcasts, vodcasts and vlogs, and other tools and technologies such as apps and social networks. This is by no means an exhaustive list, but provides a good overview for further research and discussion.

2.2.1 User-generated content

Before describing these technologies it is worth defining what is meant by User Generated Content, hereby referred to in this section as UGC. UGC, also known as consumer generated media or user created content (Dictionary.com, 2012), is used to describe any form of content, be it audio, video or others forms of media, that have been made by users of an online service. UGC is therefore publically available to others on the Internet. In the past, most websites were static (Ashley *et al.,* 2009) as they only had fixed content, but developments then saw more dynamic websites which generated content from databases, being introduced. Many websites now incorporate UGC, for example, in the form of discussion forums, where users post comments, or a wiki which allows for direct additions and changes to be made to the website content. Famously, social networking websites such as Facebook and Twitter encourage users to create profiles and regularly share a variety of media with one another – another good example of UGC.

Whereas sites like these contain nearly all UGC, others, such as blogs and personal websites may contain some static content, with the option for visitors to add comments or to sign a guestbook. Mixed content can also be seen on sites (such as www.bbc.co.uk/news) where members of the public may comment on news stories. The editor can then choose certain comments to add to the static content. It is often important for sites such as these to monitor the volume of UGC posted as these hybrid sites sometimes end up containing more UGC than original content.

Much media attention has recently been given to the phenomenon of UGC, perhaps because the media itself has evolved into one in which the former audience are becoming the presenters. Availability of relatively high quality cameras on smartphones has undoubtedly contributed to this. Anderson (2006) comments that:

> *"The Sun newspaper now provides a single mobile phone number for members of the public to submit copy and photos, and in South Korea the OhmyNews service has an army of 40,000 citizen journalists edited by 50 professionals. Meanwhile, the BBC is working on a Creative Archive which will allow users to view and make use of old, archived TV material, possibly 'mashing-up' their own versions of TV content."* (p.15)

Although it is possible to make contributions for financial gain, it has been suggested that a major motivator for users to generate content is their reputation. Commentators are evenly split on whether users' engagement in generating web content is completely beneficial, for example, Ofcom (2008) state that:

> *"Some teenagers and adults in their early twenties reported feeling 'addicted' to social networking sites and were aware that their use was squeezing their study time. Many users had experienced this drawback, although to differing degrees."* (p.24)

It is possible that educators may also have concerns over the difference between content that is made popular on the Internet and content that is actually 'important' in the classroom, or elsewhere. There is also some question over the true scale of participation. In 2006, Mann suggested that only 3 million of the 13 million Blogger profiles were active, stating:

> *"More than 10 million of the 12.9 million profiles on Blogger surveyed by splog researcher Vasa in June were inactive, either because the bloggers had stopped blogging or because they never got started. (The huge mass of dead blogs is one reason to maintain a healthy skepticism toward the frequently heard claims about the vast growth of the blogosphere.)" (*p.2)

If it is difficult to know what proportion of the general population engages regularly in generating web content, it is even more difficult to find out what is happening in schools. In fact:

> *"Research on the creation of online user-generated content is often conducted on American Internet users...Moreover, the scarce data on UGC in Europe is rather difficult to compare and interpret as measuring UGC is not straight forward... questions remain as to what extent adolescents adopt the practice of contributing content to the Web. Do they heavily engage in seeding, given their desire to be noticed and to express themselves, or do they resemble the previously mentioned general internet population that rarely contributes?"*
>
> (Courtois *et al.,* 2009, p.113)

Many popular online applications exist to facilitate the sharing of user-generated content. For example:

- mash-up: www.popfly.com/
- user-generated broadcasting: http://makeinternettv.org/
- general sharing of user-generated content: www.loudblog.com/
- sharing of video content: http://youtube.com
- sharing of photographs: www.flickr.com/

The researcher suggests that there is scope for further investigation here. The next section defines the ways in which Internet users may create UGC.

2.2.2 Blogs

A blog, or web-log, coined in 1997 by Jorn Barger, is an Internet-based journal or diary, posted on a web page. Users can post both text and digital media, including photographs, videos and animated GIFs, which are arranged chronologically and archived. Most blogs allow other users to comment on the entries. Blogging sites of various complexity exist, ranging from the very simple 'type and click publish' which may appeal to younger users or those new to using the Internet, to the more complex such as Blogger and Livejournal. Some, like Tumblr, are focused on short, multimedia posts and others, like Twitter, merge social networking with micro-blogging, allowing users to 'follow' each other and receive updates from a select community.

The appeal of blogs may be evident to the many people who already blog. There are, for example, over 58 million Word Press sites in the world (http://en.wordpress.com/stats/, as of 29th December, 2012). Blogging allows for a quick, online, chronological record to be kept of users' activities, thoughts or feelings. Tagging and linking allow for quick searching for similar posts by the same author. The author can choose who is permitted to comment and whether they can edit these posts, and may often respond to comments, thus making the blog a "*weighted conversation*" (Benkler, 2006, p.8) between the author and their followers, with a wider general readership. The immediacy of blogging is further commented upon by Benkler:

> *"Blogs enable individuals to write to their Web pages in journalism time – that is hourly, daily, weekly – whereas the Web page culture that preceded it tended to be slower moving: less an equivalent of reportage than of the essay."*
>
> (Benkler, 2006, p.217)

There are a number of blog hosting sites available. Sites such as Edublogs exist specifically for students and teachers. Other free website builders such as Yola have the ability to add a blog as one of the web pages. The large number of people who blog has given rise to the term 'blogosphere' where bloggers have begun to incorporate multimedia into their blogs, which will be discussed later. As of 29th December 2012, over 390 million people view more than 3.7 billion WordPress pages each month (http://en.wordpress.com/stats/).

Examples of some blogging sites are listed below:

- http://edublogs.org
- https://www.wordpress.com e.g. onceateacher.wordpress.com
- http://www.livejournal.com e.g. educators.livejournal.com
- http://www.blogger.com e.g. emschemistry.blogspot.com
- http://www.tumblr.com

2.2.3 Collaborative Editing Tools

Collaborative editing tools are web tools which are used collaboratively, to design, construct and distribute some digital media (Educause, 2005). These sites may allow users scattered across large distances, (including across the classroom!) to collaborate in making a single entity such as a film or document. As the document is held on a shared web server, the users can edit in real time rather than keeping a local copy and uploading it to the Internet or emailing it to one another. Google docs has been used for some years for this purpose but more structured sites now exist which allow the production of collaborative artefacts such as novels, mind maps, drawings or videos. Google docs works by emailing the collaborators an URL so that they may access the document to edit it.

Openetherpad works in a similar way, but the URL must be given or sent to users by the creator. Etherpads are hosted web services that allow real-time document collaboration for groups of users. Brodahl *et al.* (2011) present a case study investigating education students' perceptions of collaborative writing using Google Docs and etherpads. This study suggests that these tools are fairly intuitive to adopt for users of word processors (Brodahl *et al*., 2011). Revisions can be viewed using the 'Timeline' feature which allows all changes to be tracked. Like other collaborative tools, users may edit or delete others' work, but this can be tracked if users are assigned a different font colour. Corkboards such as Corkboard.me and Padlet.com work in a similar way, but are designed with educators in mind as users are able to post virtual Post-It notes, and organise, edit or delete other users' notes in real time. The immediacy of action may be of benefit in classrooms where instant response is often necessary, for example, during a starter or plenary activity.

Some examples of collaborative editing tools are listed below:

- www.google.com/docs

- scribblewiki.com/main.php
- www.bubbl.us
- www.virtual-whiteboard.co.uk
- www.skoolaborate.com
- www.glypho.com
- openetherpad.org e.g. openetherpad.org/p/tygzXZJGZw
- corkboard.me e.g. noteapp.com/qZLNjwIvPm
- padlet.com (formally Wallwisher)

2.2.4 Wikis

A wiki, from the Hawaiian word 'wiki wiki', meaning 'quick' or 'hurry' (Anderson, 2007, p.8), is a webpage or website which is easily edited by its users, to facilitate group work. Access is usually permitted by the wiki creator and users may then add, edit or delete content on any page to which they are permitted access, using their own web browser. Editors may be WYSIWYG ('what you see is what you get') or a more complex online editing tool, and pages are linked via hyperlinks. Examples of WYSIWYG editors are Adobe Dreamweaver or VisualEditor as used by Wikipedia.

Unlike blogs, which are organised chronologically, users may organise pages and posts in a wiki as they wish, and their history function allows previous versions to be viewed and readopted. This is clearly useful if a user has posted something inappropriate, or has deleted or edited something in error. Wikipedia itself has suffered from problems of malicious editing and vandalism (Stvilia *et al*., 2005); an issue which will undoubtedly arise with such open systems, so the ease at which mistakes can be rectified is a clear benefit. Alternatively, restricting access to registered users is often used for professional, work group wikis (Cych, 2006). Like blogs, wiki sites exist that allow students and teachers to establish their own wiki, with an educational slant such as Wikispaces and PBwiki (now PBworks), which are free to set up for classes and can be controlled by teachers.

Examples of these wiki sites are listed below:

- pbwiki.com/education.wiki (now pbworks.com)
- www.wikipedia.org
- www.wikispaces.com e.g. labbookonline.wikispaces.com

2.2.5 Websites

Although not always considered Web 2.0 technologies, a number of website generators have recently evolved. Whether websites and applications should be considered to be Web 2.0 technologies is dependent on how many of the core competencies are demonstrated (O'Reilly, 2005, p.1). Website generators such as Yola (www.yola.com) and Weebly (www.weebly.com) can be considered part of the read-write web because, like blogs and wikis, they encourage users to create content and publish it online. Several sites exist which are simple to use and allow users to publish their website to the Internet for free. Three popular examples are listed below:

- www.yola.com e.g. www.year9.yolasite.com
- www.wix.com
- www.weebly.com e.g. www.emits.weebly.com

2.2.6 Forums

A web forum (Chen *et al.,* 2008), also referred to in the literature as an Internet forum, discussion board, (Crook *et al.*, 2008) or online bulletin board (Chai *et al*., 2010) is a section of a website, or a website itself which allows for collaboration and communication via UGC of, usually short, text and multimedia messages and links. These messages are arranged in topics known as 'threads' in which users can post new comments or create a new thread. Forum users may have to log in to post their comments, but many forums allow anonymous viewings of posts without a log in. Forums are incredibly popular web communication tools (Kan *et al*., 2013) and they exist for a great number of topics, both general e.g. education and specific e.g. science teachers. A popular forum will grow as long as members continue to post and it is important that the webmaster of the forum monitors the content and structure. This can be a time consuming and daunting task for popular forums although most forum software can filter out some inappropriate content.

Many schools have the ability to create forums within the walled garden of their Virtual Learning Environment (VLE), where users must log in before being able to even view the forum. This may give educators the security they desire when they require students to discuss a topic openly, though they should remember that by setting up a forum, they are responsible for monitoring content. This means they may frequently have to deal with off topic, inflammatory or otherwise inappropriate posts, whether that means deleting, locking or moving threads, and the necessary disciplinary follow-up at school. Although they both allow users to collaborate and generate content, forums differ from wikis as other users are not usually able to edit others' posts. This level of content manipulation is reserved for moderators or administrators on most forums. They also differ from blogs as the conversations are not necessarily weighted, with many users commenting on threads, rather than the original poster (OP).

2.2.7 Content on VLEs

A VLE is a standardised software system, designed to support teaching and learning through the delivery of learning materials, via the Internet (called e-learning) and may facilitate on-line interaction between students and teachers. VLEs have also been called Course Management Systems (CMS) and Learning Management Systems (LMS) and are different to a Managed Learning Environment, (MLE) where the focus is on management. Other terms used for such systems are Learning Content Management System (LCMS), Managed Learning Environment (MLE), Learning Support System (LSS), Online Learning Centre (OLC), Open Course Ware (OCW), Learning Platform (LP); Computer-Mediated Communication (CMC) or Online Education (Pietrowski, 2009). It may be that a more appropriate term for all of these may be 'Virtual Environment for Learning' which may clarify that it is the environment which is virtual and the learning remains real. When used alongside traditional classroom activities, the use of VLEs is referred to as 'Blended Learning'.

Although common in schools, VLEs, MLEs and other content management systems are not the primary focus of this report. One reason is because the openness and rationale of Web 2.0 technology directly opposes the 'Walled Garden' of institutions' VLEs. Becta's 2008 summary report agrees, stating:

> *"Institutions must therefore decide whether to populate the established and open arenas of Web 2.0 activity, or whether to build their own versions of these tools, in order to shape or contain that activity. In fact, there is nothing new in the principle of classrooms using ICT to create a collaborative but self-contained community of learners, tackling authentic problems, and expressing solutions in new digital formats...Teachers may prefer the intimacy and security of such protected groups, rather than the uncertain openness of the wider internet."*

(Crook *et al*., 2008, p.35)

Many of the Web 2.0 tools and technologies previously mentioned are undoubtedly already embedded into the infrastructure of many VLEs. Forums and collaborative editing tools are popular, whilst one of the main features of a VLE is the ability to upload and download content, which may be in many forms. A popular choice for schools wishing to experiment with a free open-source VLE is Moodle. Moodle's site (www.moodle.com, as accessed in December, 2012) actually states that:

> *"Many of our users love to use the activity modules (such as forums, databases and wikis) to build richly collaborative communities of learning around their subject matter (in the social constructionist tradition), while others prefer to use Moodle as a way to deliver content to students (such as standard SCORM packages) and assess learning using assignments or quizzes."*

This indicates that Web 2.0 technologies have been fully integrated already into the VLE system. Some questions arise here: Does the integration of the forum or wiki into the VLE prevent users from collaborating more widely, or does it afford a safer environment for students to generate web content? From the researcher's viewpoint, there may be some pressure for the teacher to assure the senior leadership team of the security of the material published by the students in school. A VLE ensures that published content may only be accessed by students at the school and then with permission, other webtools can easily be used to disseminate the content if desired.

2.2.8 Podcasts, Vodcasts and Media Sharing

A major area of Web 2.0 technology growth has been amongst services that facilitate the storage and sharing of multimedia content (Anderson, 2007, p.10). Popular examples include YouTube and Flickr and millions of people now participate in the sharing and exchange of media by producing their own podcasts, videos and photos. According to YouTube (2012), 72 hours of video are uploaded to YouTube every minute and over 800 million unique users visit YouTube each month, although not all of these users will be content-creators. Similarly, Flickr hosts eight billion photos from more than 87 million users and more than 3.5 million new images are uploaded daily (Jeffries, 2013).

Podcasting is becoming increasingly used in education (Brittain *et al*., 2006; Ractham and Zhang, 2006) and recently there have been moves to establish a UK HE podcasting community. A podcast is a type of digital medium consisting of an episodic series of audio files subscribed to and downloaded via the web or streamed online to a computer or mobile device. The name "podcast" is derived from "broadcast" and "pod", given that they are often viewed on portable media devices such as iPods, though they can also be watched or listened to on any computer using Apple iTunes, for example. When the podcast contains video files it is sometimes referred to as a vodcast. Vlog is short for "video blog" and is a blog, or web log, that includes video clips. It may be entirely video-based or may include both video and written commentary. Several types of vlogs are available on the web, including instructional videos, travel updates, and personal commentaries. Unlike audio podcasts, vlogs may be posted to YouTube and this is often the case as users may think that their video is more accessible. Additionally, YouTube offers free video hosting and this may be appealing to many vloggers.

The popularity of podcasts and vlogs has been made possible through the widespread adoption of high quality, cheap digital media technology such as ‘Flip’ video cameras. Podcasts, both professional and amateur, exist on the Internet in abundance. They are easy to create and can be made by anyone who has a microphone (podcast) or digital video camera (vodcast) and a computer with recording software. They can also be distributed freely on the Web. A simple link to the podcast will open the file in iTunes, making it possible for anyone with a website to publish podcasts. Free software such as Audacity may be used for recording and editing podcasts. Podcasts are often distributed in "episodes," meaning new podcasts are often regularly available and users may subscribe to these, using, for example, iTunes to download them automatically.

In education, podcasts of talks, interviews and lectures, have existed for many years although they are becoming more common and better quality as better audio software and hardware becomes more freely available in schools. Some examples of multimedia sharing sites are:

- www.flickr.com - photos
- www.youtube.com - videos
- www.videojug.com - videos
- www.apple.com/itunes/store/podcasts.html - podcasts
- www.bbc.co.uk/podcasts - podcasts

2.2.9 Other Webtools – Social Networks

On 30 April 1993 CERN published a statement that made World Wide Web technology available on a royalty-free basis (See Appendix 4). Since then, users have been able to create home pages and post content to the web. However, these sites lacked the sense of community of the social networking sites which were introduced in the early 2000s. It is not difficult to see why social and professional networking has become so popular. Websites, such as Facebook and MySpace provide users with simple tools to create a profile, which can then be shared with a wider virtual community. A typical profile, consisting of a blog or 'wall', photographs or videos, applications and some basic user information, allows users to share their lives with other people without needing to develop and publish their own home pages. They are able to reconnect with lost acquaintances, meet new people and keep in touch with friends and family, no matter the distance apart. However, caution must be used if the general public can view one's profile, and it is vital that privacy settings are explored and discretion is used to ensure any potential future embarrassment is not caused.

Crook *et al.* (2008) report a tension here, saying that it is due to the permanence of these media:

> *"Material that is posted in Web 2.0 contexts has a way of haunting the poster. In contrast, thoughts that are spoken are transitory and thus potentially ignored or forgotten. They may also be reviewed and revised in the light of feedback. Even print on paper offers a better protection from embarrassment, for thoughts laid down this way may circulate far less widely."* (p.42)

This is an important consideration when planning to use social networking in schools. It has been argued (Dennen, 2005) that students may not participate fully in Internet discussions on such sites because they recognise that their posts may remain for longer than their thoughts last, and may attract a wider audience than they intend. Others have suggested (Boyd, 2008) that users have become more sensitised to privacy issues due to social networking. Students may be unaware that companies view the social networking profiles of potential candidates before job interviews and schools need to have a similar awareness of their institution's Internet presence on these, somewhat uncensored, sites. One 2012 survey conducted in the US by Harris Interactive found that 37% of the employers surveyed used social networking sites to research potential employees (Careerbuilder, 2013).

Indiscretions exhibited on social networking profiles may also harm users later in their careers. Rosenblum (2007) comments on this:

> *"Youthful "indiscretions" or posturing, and the exaggerated role playing that social networks encourage, can become career liabilities, because the limited audience to which the post was directed is not the only audience actively viewing it."* (p.43)

Some local authorities, such as Leicestershire and Leicester City, do not permit access to social networking sites in their schools. For example, East Midlands Broadband Consortium *(EMBC),* who provided the National Education Network for schools in the East Midlands in 2011, restricted access to sites such as Facebook and Bebo for both staff and students. YouTube was also not available for students and was only available to staff if they could log in to the EMBC site (now Openhive).

Recently, there have been a great volume of new ideas, applications and start-up companies working on ways to extend services that already exist in the Web 2.0 world. A table of these has been collated by Anderson (2007, p.13). The relevance of these applications, especially with regards to their potential in education, is a matter for review. Unfortunately, it is difficult to keep track of the applications that exist and their capabilities. Sites such as 'Cool tools for schools' (http://cooltoolsforschools.wikispaces.com*)* have catalogued and categorised some of these webtools, but even so, this is clearly a fluid market with new tools and start-up companies being announced on a regular basis. In fact, eConsultant's Web 2.0 directory recently listed over 1,200 services in fifty categories, ranging from blogging to Wi-Fi.

Some examples of professional and social networking sites are listed below:

- www.uk.linkedin.com
- www.myspace.com
- www.facebook.com
- www.bebo.com

2.3 What are the advantages of learners generating content using Web 2.0 Technology?

Prior to the implementation of Web 2.0 technologies for educational purposes, it is important to consider how and why they may impact positively on teaching and learning. Yuen *et al*. (2011) agree, stating:

> *"Using a Web 2.0 technology or tool in the classroom without considering pedagogical theory could be compared to using power tools to construct a house without first consulting an architect."* (p.111)

The literature suggests that there may be many advantages of using Web 2.0 tools in the classroom. In 2008, Ajjan and Hartshorne surveyed 136 university instructors to determine their perceptions of these pedagogical benefits and found that blogs and wikis were easy to integrate, increased student-faculty interactions and improved students' writing skills and their overall learning. They also found that social networks and wikis were likely to increase interactions between students and improve their course satisfaction. More recently, An and Williams (2010) reported that use of Web 2.0 tools increased students' feeling of being members of a learning community by increasing interaction, communication, and collaboration. Half of the teachers in their study also said that the technologies assisted in the creation of environments where they could facilitate learning rather than distribute content. Teachers found that Web 2.0 technologies were suitable for students without advanced technical skills because they are flexible and easy to use, and students subsequently improved both their literacy and technological ability through the use of these webtools.

Crook *et al.* (2008) found that 82% of teachers they surveyed indicated that their students needed more experience of collaborative learning and most thought that Web 2.0 tools could support such collaboration, even if many had never used these tools before for this purpose. Some of the educators in the study (op. cit.) also found that simultaneous, extensive, learner-directed discussions were encouraged through the use of these technologies in lessons. Practitioners noted that Web 2.0 engaged many learners who were not confident with contributing otherwise in lessons and allowed these students to gain confidence and improved their skills in speaking and presenting. Merchant (2009) comments that:

> *"Claims that children and young people are now engaged in unprecedented levels of participation may be exaggerated and born out of a particular kind of technological determinism...but nonetheless the potential of Web 2.0 technologies to connect learners in new ways should not be ignored."*
>
> (Merchant, 2009, p.15)

It is worthy of note that publication of work was felt to enhance a learner's sense of ownership, engagement and awareness of audience. Web 2.0 technologies afford this opportunity well, although some educators report (Crook *et al.*, 2008) that they would prefer to publish students' work on the school's VLE. Teachers also comment that Web 2.0 tools allow students to be good independent enquirers but many were also aware that they may need guidance in this process, as students may initially use these Internet-based resources tentatively or with some suspicion.

2.4 How are Web 2.0 Technologies being used?

The next section details how Web 2.0 technologies are being used by secondary school students, both socially and in the classroom.

2.4.1 Students' social use of Web 2.0 technologies

It is widely accepted that students heavily engage with Web 2.0 technologies in their social life (see for example Lenhart *et al*., 2005 and 2007; Ofcom, 2008). However, there exists little research as to how these users distribute their engagement across the various resources of the Internet. The literature suggests that social networking may contribute to the majority of their Web 2.0 activity (Ofcom, 2008) but it is unclear as to how other web tools are being used and more importantly, how many students actually produce any web content. Arthur's (2006) one per cent rule suggests that only 1% may produce the Web 2.0 content, whilst 10% comment on it, and 89% consume it. Courtois *et al.* (2009) also state that:

> *"Bughin (2007) argued that only a fraction of Internet users is responsible for the majority of the content added to the Internet. For instance, figures show that about 2% of the Wikipedia users are responsible for 60% of the articles."* (p.111)

However, Lenhart *et al*. (2007) report that more than 50% of all teens who go online create content for the Internet. They define content creators as:

> *"…online teens who have created or worked on a blog or webpage, shared original creative content, or remixed content they found online into a new creation."* (p.1)

This may not take into account that these users may view publishing content on social network profiles as generating content. Who is to say that this is not a relevant activity? However, this not is what is generally meant by students engaging with Web 2.0 and UGC. Further investigation needs to take place into how students are engaging with webtools outside of social networking. Crook *et al.* (2008) support this, concluding that:

> *"In short, what young people are doing via Web 2.0 needs to be better understood in relation to the real scope or 'depth' of their engagements."* (p.19)

For this reason, some questions need to be raised as to researchers' wording of their survey statements when considering examples from the literature and there is scope for further research in this area.

2.4.2 The current situation in secondary schools

There are some clear issues when researching the use of Web 2.0 technologies in secondary schools. There is little documented empirical research and what research exists is mostly in the form of case studies and is largely described on forums and as blog postings. It is possible that some Web 2.0 tools are being used in schools more than others and a brief review of the literature quickly indicates that VLEs, wikis and blogs have been used in classroom research. For example, Lund and Smørdal (2006) detail how a MediaWiki was used by a class of Upper Secondary School learners in Norway. They argued that teachers play a key role in developing design principles that *"balance learner exploration with a more goal directed effort"* and that "*educational wiki designs need to allow such a role in order to support group knowing"* (p.37).

Similarly, Désilets and Paquet (2005) discussed a case study of collaborative storytelling in a primary school setting. They showed that teams of 2 to 5 students at the primary level Grade 4-6 were able to successfully use a wiki for their collaborative web-based storytelling tasks. Murphy and Lebans (2008) presented a small-scale study into the use of a webtools in which teachers commented on the use of Moodle, blogs, wikis, and videoconferencing. In their study, Crook *et al.* (2008) described social networking, blogging, editing wikis, posting to a forum and media sharing as more prevalent activities and media manipulation, social bookmarking, collaborative editing, syndication and recommender systems as less prevalent activities.

If some secondary schools are using Web 2.0 technologies to support teaching and learning, as empirical studies in the appeal and impact of Web 2.0 practices are rare, there may be some opportunities in this area for investigation. This lack of research could be because these web tools are poorly represented in the curriculum and so are difficult to investigate, or it could be that few researchers have concentrated on this area so far. Blogs and other informal accounts do exist on the Internet which detail successes in secondary education, though these are usually case studies and may be subjective. Crook *et al.* (2008) also comment that:

> *"While there is a disappointing volume of research directed at secondary school Web 2.0 usage there is rather more within higher education."* (p.50)

Indeed, Sendall *et al.* (2008) conducted a review of Web 2.0 tools at three US universities and found that students who took the relevant course and were educated on Web 2.0 skills increased both their knowledge and their level of comfort. They also concluded that blogs, wikis and social networking skills were judged to be useful in the workplace, as well as the classroom. There are many other studies, but as this report concerns the implementation of Web 2.0 technologies in secondary education, these will not be discussed further.

Of the papers reported by Crook *et al.* (2008), around 15% were concerned with Web 2.0 issues and of these; 8 were describing wikis, 5 were empirical reports on blog use, 5 were reports on podcasting, and 3 were social networking structure studies. However, this study also found that writing to a discussion board was the most prevalent Web 2.0 activity amongst teachers and their students at school whilst social networking and editing a wiki were the least common activities in the classroom. Teachers had some experience in uploading videos that had been filmed in their lessons, and creating or writing blog posts but none of these activities were used as often in the classroom as the teachers used them at home.

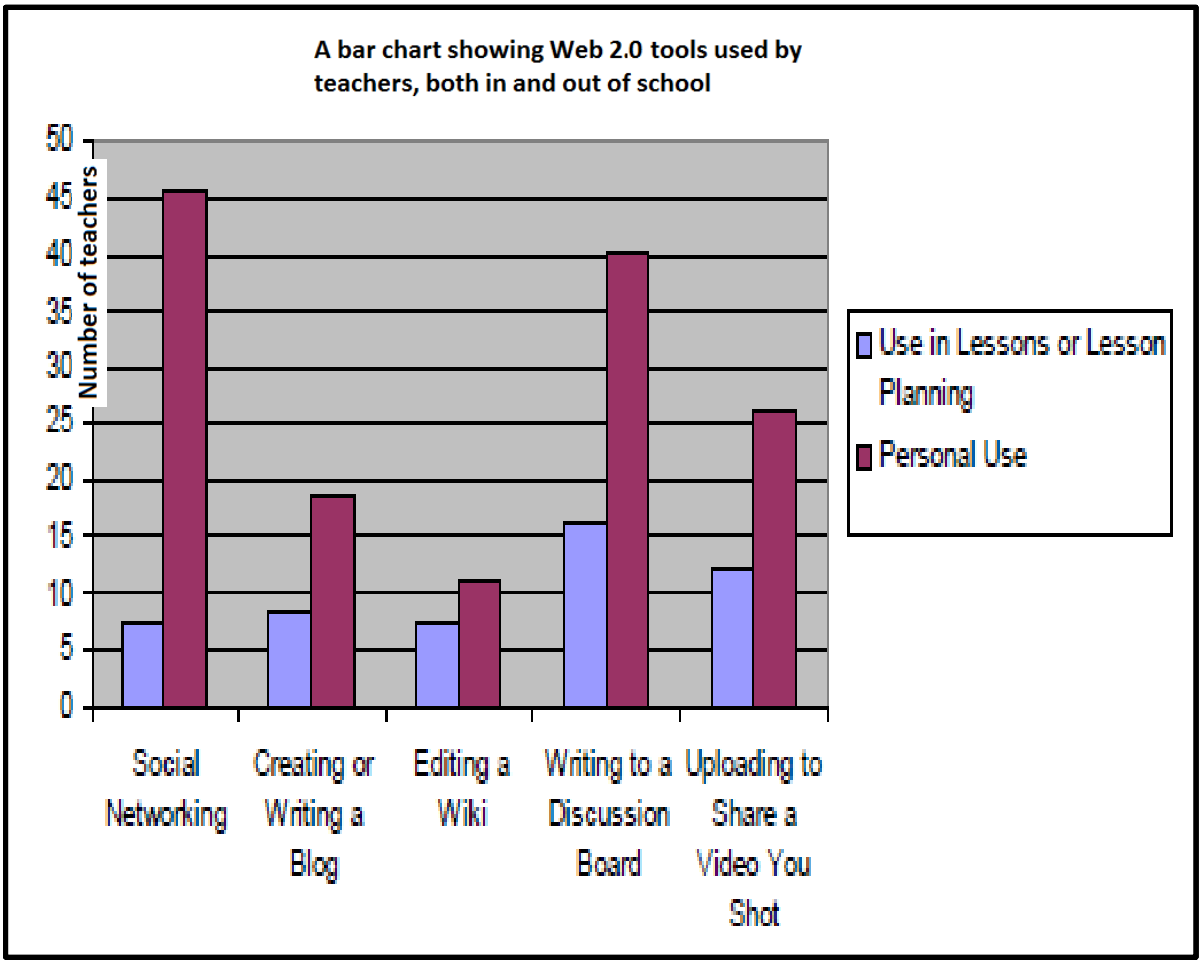

Figure 2.4.2: Use of more prevalent Web 2.0 tools by teachers in normative and Web 2.0 schools (Crook *et al.,* 2008)

There is little clear evidence in the literature as to why some Web 2.0 technologies are taken up more readily than others. In their study, Ajjan and Hartshorne (2008) found that the factors which influenced whether a Web 2.0 technology was implemented were how easy the tool was to use, how useful it was and if it was compatible with current practice. Furthermore, they found that teachers' attitudes were also dependent on their peers, students and superiors, and these attitudes strongly affected whether Web 2.0 tools would be used in their classrooms. Other factors such as the teachers' familiarity with the potential of different technologies and beliefs about how their students learned, affected whether teachers intended to use these tools (Crook *et al*., 2008).

2.4.3 Blogs and Wikis

Some research papers suggest that blogs and wikis can be successful in secondary contexts. Lund and Smørdal (2006) described an empowering wiki project, although it was observed how difficult it can be for students to move towards willingly editing the text of their peers. There are few large scale research activities which focus on the use of blogs and wikis in secondary education, though smaller case studies like Lund and Smørdal's do exist in the literature. Teachers may see blogs as diaries or spaces for interaction between those with shared interests. In one study, Crook *et al.* (2008) found that 71.1% of teachers reported never having used a blog and teachers were divided over whether they thought it was important for students to keep blogs in schools. Nonetheless, teachers in the study used blogs to record or follow information, opinion and ideas. They were also used for sharing good practice, and personal reflection. One teacher used his blog to embed YouTube video clips for students to view, and found that students then commented on his blog rather than on YouTube, encouraging engagement. Other teachers talked about students 'taking over' responsibilities for blogs set up by teachers. Some teachers used blogs with students, to set open-ended tasks with structured support provided through the blog, with the goal of encouraging enquiry and empowerment.

In the study conducted by Crook *et al*. (2008), blogs were found to be useful both for in-class activities and for extra-curricular activities such as debate, peer assessment and commenting on shared experiences. In another situation, a group of Glasgow primary school students wrote poetry and published it on their school blog. They received comments from all over the world which made the children realise that what they created was meaningful and motivated them to continue to create new material (Alden, 2006). However, there may have been some potential disadvantages of this task. If, for example, the students received any negative feedback or abusive messages, the teacher would have to monitor the blog closely and regularly from then on, and be capable of removing the messages if necessary. This may take time and expertise. It would have also been necessary for the teacher to ensure the e-safety of the students by monitoring the information which they shared via the blog.

Wikis can be used in the classroom in similar ways to blogs, but they also allow for online collaboration among groups of students. Multiple classes or even multiple schools can collaborate to write online articles and the wiki structure makes it possible for several students to work on the assignment concurrently. Crook *et al.* (2008) provide one excellent example of a wiki being used to generate some rules for working in the ICT suite:

> *"One of the first exercises that [the class] did was to compile a wiki – I put some rules on about you must run around in the class and you've got to chew and spill drink on the keyboards and they were all aghast at this, and I said 'Well, you can change it if you like'. I showed them how to change a wiki and after 17 iterations we'd got a set of class rules that I couldn't have bettered myself. So there was that community built up around the wiki… they all felt that they had a choice in what they said and did and that they were able to affect those around them by helping make the rules."* (p.22)

The study found that 75.2% of teachers had read a wiki and 46.4% of teachers agreed that students should have the experience of contributing to a wiki, although relatively few examples of students doing this actually existed. Some teachers in this study, unsurprisingly, found that wikis were unsuitable as document repositories, and were unable to cope with the conversational demand generated, and moved from wikis to more appropriate discussion forums. When looking at collaborative digital learning in schools, Austin *et al.* (2010) found that teachers thought that exchanging messages in a forum was easier, technically, than making a wiki. The teachers that were able to make better use of the wiki were ones that had either participated in training, could see the benefit of the wiki and therefore made it part of their professional development or already had a high competence in ICT. They also commented that video conferencing worked well if it could be integrated smoothly, and that some schools found that it helped to make students better orators. The study concluded that:

> *"Where teachers were able to deploy all the tools, it led to outstandingly innovative and creative work."*
>
> (Austin *et al*., 2010, p.53)

In their study of wikis in post-secondary classrooms, Hughes and Narayan (2009) found that:

> *"While the theoretical and research literature posits that wiki technology supports collaborative learning...wiki use does not always*

> *have to be collaboratively enacted for it to be perceived as supportive of learning."* (p.74)

Their study also found that the technical aspects of the wiki, such as the complexity of the text editor, may influence how students perceive the wiki for collaborative learning. This indicates that the choice of wiki may be important when deciding whether to use them with a class. In order for students to perceive that their learning has been aided, a simple WYSIWYG (What You See Is What You Get) editor may be preferable, such as the one used on the free Wikispaces sites.

2.4.4 Collaborative editing tools, etherpads and free website generators

Despite the growing popularity in workplaces of collaborative editing tools, few schools in Becta's study (Crook *et al.,* 2008) engaged in collaborative editing between students. Examples given were either not strictly using Web 2.0 technologies or merely utilised the functionalities of the institutions' VLEs. Where collaborative editing did occur, it was largely between teachers and students and the reason given as to why this was an issue was often quoted as lack of access to computer suites. Indeed, a comprehensive search of the literature provides few uses of technologies such as etherpads being used in secondary education (for example a Google Scholar search of "etherpad "secondary school"" yielded 20 results and "etherpad "secondary education"" produced only 9 results, as of December 2012). There is an opportunity and potential here for further study.

Similarly, when investigating the use of website generators such as Yola and Weebly, these sites provide their own examples of where educators have used their tools in lessons to permit students to create content, but these exist in one or two line endorsements rather than more comprehensive journal articles. Williams and Chinn (2009) report a project in which US university business students were to promote increased attendance at a basketball game. As part of their project students reported that they:

> *"Created free website. Included team photo and information, game details with a countdown clock. Also added pages with more information such as captains and roster. Added a poll to get people to vote on who will win. Included the coupon link and asked people to*

> *print it and bring to the game. Also added link to this page in our other activities and shared with the rest of the class."*

(Williams and Chinn, 2009, p.170)

The researcher found that a thorough review of the literature provided no examples, to date, of science teachers in secondary education asking students to make free websites for revision purposes, or otherwise, and therefore concluded that there was potential here to contribute significantly to this field.

2.4.5 Forums

Forums are often used in education to allow students to post contributions on a particular topic, and allow other users to reply. They are readily understood by teachers and although they are well established in some schools, though not in all subjects, they are not used at all in others. The forums reviewed by Crook *et al.* (2008) were normally 'closed' forums, hosted within the school's VLE and teachers were generally expected to moderate the forum postings themselves. Forums seemed to be a fairly accessible as 44.9% of teachers felt at least competent with their use and were perceived to have significant potential for learning as they could support weaker students through monitoring and additional, targeted prompts and higher-ability students, through extension materials and activities. There may be some disadvantages here though, as over half of the teachers did not feel competent. This may have been due to lack of access at school, or lack of experience with using forums as a social activity. The study found that the most effective forum tasks occurred when there had been some prior classroom preparation and that in some schools they were used mainly for homework tasks.

2.4.6 Content on VLEs

It is not generally known how far VLEs are harbouring Web 2.0 activity. Crook *et al.* (2008) recognise this, saying:

> *"It would be a daunting task to systemise and evaluate all the references to Web 2.0 initiatives that are mentioned through conversations and accounting in the Web 2.0 arena. Moreover, there is every reason to believe that there are many more lurking behind the walled gardens of*

> *learning platforms thanks to their designs commonly including the relevant tools. Of course, this marginalisation of learners from the mainstream of Web 2.0 activity is not totally in the spirit of its ideals."*
>
> (Crook *et al.,* 2008, p.50)

Crook *et al.* (op. cit., p.49) also suggest that some may feel that it is unimportant to review use of Web 2.0 technologies if they are being hosted on VLEs and other learning platforms, stating: *"…some commentators suggest that such walled garden activity does not count."* However, it is not clear if they refer to the participants in their study, or the research in general. Although using webtools on VLEs may hamper wider inter-establishment collaboration, students are still able to generate and share content on a local level, so some review of VLEs is surely necessary. Still, the researcher agrees with Crook *et al.* that reports of web 2.0 initiatives using VLEs seem to be more difficult to find than accounts of work with podcasts, blogs and wikis.

In 2008, a team of Ofsted inspectors visited a range of urban and rural institutions - eighteen colleges, eight schools, three work-based learning providers, three adult and community learning providers and one local authority. They also reviewed five colleges and four school VLEs by accessing them via the Internet. Of the 41 providers contacted, 35 had active VLEs and the six providers who did not have an active VLE gave details of their plans for resources, staff training, use with learners, and their concerns. Perhaps unsurprisingly, all the institutions using VLEs that were surveyed by Ofsted in 2008 were still developing their VLEs as they had all been built up slowly rather than being the result of a carefully planned launch of a final product but the schools who were not yet using a VLE were anticipating a structured start when their learning platform was introduced.

In most cases, initial use of the VLE was driven by a desire to improve the effectiveness of planning and submitting work, and giving feedback on assessment. This element of communication although present in all VLEs reviewed was not the only method used. A few providers linked their routine communication systems and the VLE in an attempt to encourage staff to use the VLE. This was met with varied success, given that although all providers had at least one good area, no VLEs seen gave fully comprehensive cover across all curriculum areas and only four courses were seen that were designed to be used exclusively outside the classroom. There did not seem to be a particular subject area that was covered more, or less, other than ICT. However, in most providers this consisted mainly of copies of work that had been done in class. In fact, the survey showed that how well populated the subject area was, was due to the enthusiasm of the member of staff responsible for that area. Neither was there correlation between computer skill and content.

Ofsted (2009, p.13) said that the most effective VLEs seen were from providers who had a clear strategy, use of champions, good support from technical staff, and helpful staff training, where learners had the opportunity to reinforce their routine work as well as the chance to catch up on missed material for courses and to extend their deeper knowledge and understanding of their subject. The least effective VLEs were just used as a filing system for notes. Eleven institutions had noted that the use of a VLE had improved motivation, interest and learning, with nine commenting that allowing learners to catch up on missed lessons had improved retention.

The Ofsted study (op. cit.) showed that the way that learners were using the VLE varied from institution to institution and between departments, and was limited by how the provider was populating and using the system. In a quarter of the schools and colleges, students used the VLE to communicate between each other and with staff and most of the students interviewed were happy to use computers as part of their learning even if this was not to access the provider's VLE. Using the Internet and word processing were seen as normal practice. However, if students were to have a positive attitude towards using the provider's VLE, they needed a good induction and then to use a working system early on. Nearly all learners used the VLE to submit assignments and receive feedback.

VLE usage was directly linked with tutor encouragement and interestingly, there was no obvious link between use of VLE and age, with younger learners being confident with using ICT and keen to exploit the use of the VLE, or not enthused at all, and older learners less confident with using computers to access learning material but more enthusiastic about accessing support. Even though social networking sites are currently popular, the Ofsted survey (op. cit.) indicated that all learners were not inclined to use the VLE for general and social purposes, as opposed to specific learning reasons.

2.4.7 Podcasts, Vodcasts and Media Sharing

In their report, Crook *et al.* (2008) found that 74.5% of teachers thought that students need more experience of uploading and downloading text-based documents and multimedia presentations. Proficiency in communicating using visual and audio media was important to over half of the teachers surveyed. However, as access to YouTube is often blocked in schools (Mullen and Wendwick, 2010, p.68); for example Leicester City school teachers may only access it via Openhive (openhive.net); innovators in only a few schools (Crook *et al.,* 2008, p.6) reported its use.

In some schools, teachers were making extensive use of 'vokis' – where an avatar on a website is used to replay a sound recording of a student or use text which is turned into speech. These were used to support evaluation and improvement. In the Becta study, podcasting was only used experimentally or sporadically in the schools, although other research does exist in this field (for example, Dale and Povey, 2009).

2.4.8 Other Technologies – Social Networks

In the UK, Ofcom (2008) reports that half of children aged 8 to 17 who use the Internet, have set up their own profile on a social networking site. Worryingly, around 40% of these teenagers with a personal profile report that it is visible to anyone who happens upon it online and this is concerning to many commentators. Selwyn (2008) reports that:

> *"Whilst one in five adult users currently maintain a social networking profile, this rises to around three quarters of secondary school pupils and nine in ten university students." (p.20)*

Other studies suggest that in 2008, around three quarters of Key Stage three and four students, and less than half of teachers have a social networking account, such as Facebook or Bebo (Crook *et al.,* 2008) but as these sites are usually blocked in schools, despite students' attempts to bypass servers to gain access, social networking is rarely part of the ICT curriculum. Teachers may also express concern about e-safety when using social networks, which will be discussed later in this report. The blocking of sites appears to be such a major barrier that some schools move to using VLEs just to overcome the issue. One school, a large, mixed,11-18 academy (Crook *et al.,* 2008, p.120) found an innovative approach to using social networking whereby they created their own 'portal', containing blogs, file uploading facilities, an e-portfolio and student profiles, which they could edit. Students were also able to send instant messages to one another, which although requires careful management, was viewed positively overall and the school planned on encouraging more departments to use the facility the following year. Crook *et al.* (2008) commented that:

> *"Teachers perceived that it is popular with students because it is easy to use, and there is a degree of student ownership and control, although everything can be monitored by teachers. The students who participated in focus groups had mixed views on the instant messaging facility. It was not used outside school as public messaging systems were perceived to be better."* (p.19)

There has been some evidence in the literature that social networking and instant messaging (IM) benefits pupils who find it difficult to communicate verbally in class and there is also evidence that using such networking sites provides benefits for students with low self-esteem (Ellison *et al.,* 2007). This raises the additional question of whether students with special educational needs find IM beneficial as well.

2.5 What issues should be considered when using Web 2.0 in schools?

There may be several barriers to using Web 2.0 technologies in the classroom environment. The following section examines these issues in detail, by providing examples of studies where these tensions have been raised Some of these fears may be justified and there are undoubtedly many implementation issues related to the use of Web 2.0 technologies in school and colleges, and much more to a successful lesson using these tools than the discovery and use of software. The implementation must be well managed, with a sound network infrastructure in place at the school and regular opportunities for review and improvement to the way in which the technologies are used. This section, therefore, also details the issues involved which must be considered when implementing Web 2.0 technologies in an institution and provides suggestions on how to manage staff and student fears.

2.5.1 Teaching and Learning issues

The first barrier concerns issues related to teaching and learning and the perceptions both teachers and their students hold about using Web 2.0 technologies. Crook *et al.* (2008) reported that in their study, there was a generally high level of awareness and understanding among teachers of Web 2.0 technologies and their use by students, but although nearly all teachers surveyed were active Internet users, active Web 2.0 users were a minority. 54% of teachers believed that 'Web 2.0 resources could support more effective collaborative learning' though others were unsure or said they did not know enough to decide. Similarly, 59% believed that popular web tools should get more use in the classroom, but concerns were still raised about time, control and trust. Though teachers in their study could see the benefits of using Web 2.0 technologies, An and William (2010) found that teachers proposing to use Web 2.0 technologies, reported that students were uneasy about discussions held in such an open public domain. They also stated that a fear of lack of technical support, computer access and problems due to the 'in-progress nature of many Web 2.0 tools' were issues, as was the time needed to learn and manage these new technologies. Similarly, Burke *et al.* (2009) found that locating appropriate video resources may take time and Crook *et al.* support this in their Impacts, Barriers and Issues report (2008), saying:

> *"More than a third (37.4%) of teachers believe that adopting Web 2.0 resources would be time-consuming for them, and teachers frequently (18.7%) and occasionally (47.0%) find that student use of the internet in class can be hard for them to manage."* (p.51)

This may indicate that Web 2.0 technologies are still new to so many teachers. They added that there may be other potential barriers to teachers' adoption of these webtools, such as a fear of becoming reliant on technologies that subsequently become unavailable, or that using the Web 2.0 technologies would negatively impact on their timetables, which are already full. Teachers may be concerned that students will not stay on task when using the Internet and must therefore manage this behaviour, as with all other behaviours, by setting clear boundaries. Monitoring software is used in some schools to address the issue and may also prove an effective solution. Regardless, it is the responsibility of teachers to teach their students to focus on the study resources. They (op. cit.) commented in the May report, that:

> *"Individual practitioners may find it hard to decide whether this must be prioritised or whether they should welcome the volatile exploration that might be more naturally encouraged by interactions within Web 2.0."*
>
> (Crook *et al.*, 2008, p.46)

More extreme fears were also reported, for example, that technology in general will have a negative impact on education or on society as a whole. Considering these views, it may not seem surprising that the majority of the responding faculty in Ajjan & Hartshorne's study (2008) did not use any Web 2.0 applications in their classes and had no plans to use them in the future.

In 2007, Professor Tanya Byron reviewed the risks that children face when using the Internet. Her report, "Safer Children in a Digital World", was published in 2008. The formation of the UK Council for Child Internet Safety (UKCCIS) was recommended and at the first summit Byron was asked to review the progress made. This progress review, "Do we have safer children in a digital world?" was launched in March 2010. Under the Coalition Government in 2012, the remit of UKCCIS was extended but the work of UKCCIS is still informed by and based upon the principles set out by Byron.

There is some evidence that although adults may be confident with the use hardware like televisions, which they have grown up with, they may be fearful of allowing children to have access to the Internet. She comments that:

> *"In the course of my Review many of the people I have spoken to characterize this as many adults being of the Web 1.0 generation (using the internet to search for information or for shopping) while our children are the Web 2.0 generation, using the technology in increasingly sophisticated ways to create and upload their own material."*
>
> *(Byron, 2008, p.23)*

It is postulated that educators may have similar concerns with using new technologies due to this digital divide, where they fear that the students are more adept at using webtools than the teachers.

Educators may also be actively resistant to changes in shifts in control or management of the educational experience, and fear that they may lose their authority in the learning process. These fears are not justified, however, and although webtools may encourage a more learner-centred experience it need not imply that the role of the teacher is less important. Moreover, teachers may have a significant role to play in encouraging their students to contribute effectively, as it is not necessarily true that although many students enjoy using Web 2.0 tools recreationally, that they will all carry this enthusiasm into the classroom. Nor does it imply that any initial enthusiasm will continue when their contributions are examined and critiqued by their teachers and peers.

2.5.2 Time issues

As stated previously, time is one of the main barriers to the integration of Web 2.0 tools in teaching and learning. Engstrom and Jewett (2005) and Norris *et al.* (2003) suggested that the reason why technology has not had more of an impact on teaching and learning in some K-12 schools (Kindergarten until 12th Grade; UK years 3-13) was due to a lack of access to that technology, but with the vast array of free tools now available online this must surely now not be the reason. The researcher postulates that a lack of time to correctly research, set up and maintain, what could be, in the case of a wiki, a very large number of webpages, is likely to be a greater hindrance.

Innovative teachers will need time, which is often not available, to try out new webtools, identify how they may be of use in the classroom, and develop resources and lesson plans which incorporate them. Even when trained specifically in the use of Web 2.0 technologies, by institutions such as the National Science Learning Centre, there may not be time during faculty meetings to disseminate this learning to colleagues. The researcher experienced this after attending the 'NAC10174 : Online Science: Web Tools and Technologies for Improving Teaching and Learning in Science' course at the National Science Learning Centre. On her return to school, dissemination of the learning was placed last on the meeting agenda, which did not give enough time for thorough review and implementation of the new tools discovered.

Crook *et al.* (2008) report that teachers currently use any non-timetabled teaching time for revision classes, using technology for administrative purposes and ensuring that the curriculum has been covered fully. One e-learning co-ordinator, who had been in post since 2006, summed this up, saying: "*They are snowed under, what with being dedicated teachers*" (p.130). This perceived, and very real, barrier may be overcome, but requires careful planning by senior leaders to allow for effective innovation to take place. Allowing staff more flexibility with their other duties and providing opportunities for whole-school dissemination could encourage more teachers to try these webtools and share their experiences.

Unfortunately the time investment required is not always seen to be beneficial and often resources are developed but then, for one reason or another can no longer be accessed. Crook *et al.* (2008) also found that the rigidity of the secondary school timetable was viewed by educators as a potential barrier and in their study, any mention of the formal assessment of work from Web 2.0 sources or where computer-supported collaboration had been involved, was limited.

2.5.3 Institutions' ICT capabilities and Access

One major issue regards the development of the learning material and the capability of the computers available to run the Web 2.0 Technologies. In the researcher's view, students who work on a university or college campus will not accept inferior teaching from poor computer systems. Even if a remote student's computer has a better specification than a typical campus computer, any low bandwidth connections will inhibit use of some resources. Most Internet tools use a client-server approach to information delivery - the user's machine contacts a server, which sends the requested information. Information is referenced using Uniform Resource Locators (URLs) which precisely locate one document.

The most common tool for exploring the Internet is a web-browser, some of the most popular being Microsoft's Internet Explorer and Google Chrome, Opera, Safari and Mozilla Firefox. There are many factors affecting the speed of delivery. The most significant of these is network congestion. Lack of bandwidth is seen to be a barrier as schools begin to access large files over the Internet, as well as uploading and downloading large files internally. One school in the local area has found using free website creators in class to be a problem due to network congestion which limits access, and sometimes it is so slow that the browser gives up waiting. In the author's experience, these often seem to work better when using Mozilla Firefox than Internet Explorer but pages may still take several minutes to load. Until the hardware and network connections or bandwidth are upgraded, use of some tools may be limited to outside school.

Some staff in Crook *et al.*'s study (2008) agreed, also reporting that their classroom computers were too slow to run processor- and memory-hungry resources such as simulations and games. Schools will have to monitor these issues carefully and consider options for increased bandwidth, for example more broadband lines and load balancing. However, even though running out of bandwidth is a concern, one school (Crook *et al.*, 2008, p.64) pointed out that an increased appetite for bandwidth may show some success, stating: *'Well, that's brilliant… it's not just internet traffic they're using this for, it's a lot of other things…'"* however, what these other 'things' are remains to be seen.

The physical resources needed to use Web 2.0 Technologies with classes may be seen as a concern by schools and colleges, as some providers may have an inadequate number of computers to allow learners access to the tools at the same time. This tension has been reported in the literature by Twidle *et al.* (2005). Some schools mention that recent investment in technology, sometimes supported by specialist status, has led to good availability for teaching and learning but where computers are organised into suites, access was still a problem because they were being used for ICT subject teaching. Some students complained that access outside lessons was poor (Crook *et al*., 2008). With regards to the software, providers often cannot afford to spend the time and money 'reinventing the wheel' and once a product has been written or material has been uploaded, it must be maintainable for the foreseeable future. It must be possible for the institutions to customise the webtools' structure to suit the needs of its students and at the same time resources need to be both good quality and reasonably cheap. There are many free webtools available on the Internet, which undoubtedly increases the likelihood of teachers choosing to use them with their students.

2.5.4 Technical Issues and Technical Support

Computer hardware and software require a level of technical support. In some schools there is an insufficient level of this support, especially support for Web 2.0 technology, so this may be another barrier to overcome. Many, but not all, schools will have a network manager or IT technician who may be able to provide some support for Web 2.0 technology implementation but as there are so many webtools available, there may not be support available for issues specific to particular tools. This is also problematic when using free or open source tools rather than bought packages; however, as these tools are becoming increasingly popular, support can often be found online.

Administrative support may also be required. A Web 2.0 tool may require the students to register in order to use it, and this may not be immediately possible. Crook *et al.* (2008) report, in their study, that this may take one or two lessons to achieve and this therefore deterred further registrations, although some schools thought that the registration process would become quicker with practice. Schools may also need to register classes, which may be time consuming if the provider does not allow for the importing of class lists from other systems. Frequently, individual teachers may take responsibility for technical or administrative support which goes above and beyond their job description.

In one Ofsted survey (2009), all providers with a VLE said that they provided individual support for teaching staff in developing material and in most institutions there had been whole staff introduction to the VLE, and then mass training on the practicalities. This initially seemed effective in encouraging VLE use but training on the detail was less effective. Providers with the best VLEs said that both departmental champions and ICT support staff were needed to suggest ideas and help staff with minor queries. Most VLE providers provide some technical support for institutions and there is often a local expert to contact, although as this can take time out of teachers' busy schedules, they may be reluctant to use a VLE unless there is technical support readily available in the form of self-help guides or FAQs. Local authority leaders (Crook *et al.*, 2008) said that teachers are no longer expected to upload content to LA websites without technical support.

2.5.5 Staff competencies when using Web 2.0 Technologies

Lack of technical skills or confidence continues to be a barrier for many educators (Crook *et al.,* 2008) and this is clearly affecting whole-school adoption of Web 2.0 technologies. Institutions seeking to introduce Web 2.0 tools should be mindful of the range of skills which will be required. Little is known about teachers' awareness of recreational Web 2.0 tools, but there is often the perception that the teacher is a digital stranger compared to the students being digital natives, as they have grown up with technology as part of their everyday lives. Teachers sometimes comment that they are risk averse with regards to implementing new technologies.

In Crook *et al*.'s study (2008) the participants mentioned the use of email, despite the focus only concerning Web 2.0 technology, which may give some insight into the time taken to embrace new technology. Although the views on email were either positive or at least accepting across all the teachers involved in the study, some teachers still commented that time was needed to keep up with it, and to a few teachers it was not seen as an integral part of their work, although studies have shown only 1% of teachers have never sent an email. In the Ofsted (2009) survey, all the staff and managers interviewed felt they had enough computer skills to enable them to carry out at least basic management of VLE content, so it is reasonable to assume staff would be able to use these skills with other web tools. However, concerns were expressed by primary school head teachers and by adult and community learning providers about the confidence and competence of their staff in working with computer systems.

In July 2008 Lifelong Learning UK (LLUK), along with the Institute for Learning, Standards Verification UK and the Department for Innovation, Universities and Skills released a position statement outlining the intended process for evidencing teachers, tutors and trainers' personal skills in literacy, numeracy and ICT but it is not clear whether this would cover the technical skills needed to create a podcast or develop and manage material on, for example, a more complex wiki or web forum. These skills may not necessarily be difficult to obtain but may still be off-putting for some.

If there is a great variation in the level of ICT skills or confidence amongst students and tutors, it is essential to consider the usability of the Web 2.0 Technologies when making a purchase, or deciding to invest time in free tools and choosing which to use in schools. Simple questions such as, how easy is it to log on, navigate around the tool and to use the design and management features, must be answered. Staff must also be provided with appropriate training to ensure that they are equipped to make full use of the technology.

2.5.6 Home Access

One consideration when implementing Web 2.0 Technologies is how they are to be used by students and others outside of school or college. Access to technology was felt by teachers to be crucial for effective Web 2.0 use (Crook *et al.*, 2008), with educators commenting that they were concerned about students' use of the Internet when at home, claiming that parents lacked adequate knowledge. This is backed up by Byron (2008). One local authority e-learning adviser reminds that parents play a key part in ensuring that students are responsible when using Web 2.0 technologies at home:

> *"Many parents feel 'Well, no, there's no problem' when they probably don't know who's been virtually invited into the household or the bedroom as it were. And I think that's an issue."*
>
> (Crook *et al.,* 2008, p.55)

Lack of access or engagement may also be a barrier. Some students may be strangers to Web 2.0 because they do not have the necessary access to the Internet, though recent studies in the UK suggest that this is rare (Office for National Statistics Online, 2013). Disengagement may also be self-imposed, if students can access the Internet but choose not to because they are not engaged by the Web 2.0 experience. Regardless, this is clearly a challenge for schools considering asking students to use webtools at home. It has been commented upon by science teachers in the researcher's school that students may not be able to access the Internet at home and the literature supports this (Crook *et al.*, 2008 p.132) concern. The researcher puts forward the theory that if teachers become aware of a divide, it may deter them from embracing these ways of working and may become an excuse for the tools to not be used, rather than finding other options for these few students. Also, these educators may have then failed to exploit the new digital interactive opportunities that have engaged their other students. Clearly, it is important for educators to be aware of whether their students would be able to use web tools appropriately and safely at home and early contact with parents or guardians is advised.

2.5.7 Financial situation of schools

There are various costs involved with the implementation of Web 2.0 technologies in an institution. This begins with the initial purchase or subscription, if necessary. None of the providers in the Ofsted (2009) survey considered the cost of software to run a general VLE to be a significant problem, mainly because most of them were using open source software such as Moodle. Fortunately, as previously identified, there are also free versions of blogs, wikis, forums, multimedia tools and social networks, all available for educators to use in schools. This cannot always be the case, and often if a user wishes to have more control or functionality, it will come at a price. For example, in 2011, Yola allowed users to create five free websites, but then required subscribers to purchase their 'silver' version. Now, users are only allowed two free sites before subscribing. Alternatively, users may simply create another account using another email address.

Anderson (2007) reports on the concerns of investing in some tools, stating:

> *"...if too much time, resources and data are invested in new and untested applications which are not subsequently supported adequately or are backed by companies which eventually fail. A great many of the new applications are not open source, but small start-ups seeking corporate backing and this means there are justifiable concerns over their sustainability."* (p.51)

Indeed, the main concern for all providers in one survey (Ofsted, 2009) was the cost of teaching staff time to develop material and the routine work of specialist staff in maintaining the system and supporting tutors. There is also some concern over whether simply purchasing enough computers will automatically mean schools are able to take advantage of free Web 2.0 technologies:

> *"Too many observers assume that if they know what the hardware is (computers, seminar rooms), they know whether student learning will occur. They assume that if a faculty get this hardware, they easily, automatically, and quickly change their teaching tactics and course material to take advantage of it. Thus technology budgets usually include almost no money for helping the faculty and staff upgrade the instructional programs."*
>
> *(Ehrmann, 1995, p.24)*

This may extend to the buying of laptops and iPads. In the researcher's school there have been significant issues with both. Laptops have been misplaced or stolen and there have been monitoring issues with Apple products. There have also been no training sessions for staff on the use of these since their purchase, and not all staff have had regular access to them either. Schools may make a significant financial investment in hardware but if development and maintenance of these is not supported, the learning benefit may not justify the cost.

2.5.8 Leadership, Training and Quality Assurance

It is clearly important that when implementing new technologies, that the process is led and managed effectively. A specific Web 2.0 strategy may help this but it is not necessarily essential if there is a form of information technology, e-learning or integrated technology strategy already implemented, which can be updated to include references to emerging Web 2.0 tools where relevant. Crook *et al.* (2008) found that for Regional Broadband Consortium (RBC) managers, leadership was 'crucial' to overcoming many of the skills issues raised by training needs. Schools may need to consider staffing structures so that innovations filter through from the 'bottom up', but are then supported by senior team members from the 'top down'. This is crucial with whole school policy issues such as the need to obtain permission from parents before showing students' work online.

Senior managers must also provide staff with the opportunity to undertake necessary training if they wish to encourage innovation with Web 2.0 technologies. Crook *et al*. (2008) and others support this view and Chen, Wan, and Son (2008) found that teachers' attitudes towards Web 2.0 technologies become increasingly positive as they use the applications in training or in the classroom. Teachers also become more confident in using Web 2.0. It can be said that good Web 2.0 tool training both increases good practice among teachers and prepares students for their future careers. Unfortunately, Crook *et al.* (2008) found that 36.9% of teachers in their study reported that they had never received training in the use of new technologies including Web 2.0, and 26.7% said they are rarely trained. Two fifths commented that their students were more confident in Web 2.0 tool use than *they* were and over half said they would like more guidance in these technologies.

Becta have suggested that although the diversity of Web 2.0 publication should be welcomed, students need guidance on how to be critical when using the Internet. This may include the temptation to copy and paste from other Internet sources when creating, for example, a wiki or photo gallery. One possible approach involves the use of writing frames to provide more structure to tasks. Students also need to be taught about plagiarism and their responsibility to generate their own content or reference others' work as appropriate. They conclude in the 'Impacts, Barriers and Issues' report that:

> *"A general principle among innovating teachers is that a discipline under study works well if students are creative around that subject, and this means that the designs emerging must be their own as far as possible."*
>
> (Crook *et al.,* 2008, p.44)

With this in mind, it is up to schools to consider how much content to display and whether students must be aware of copyright law concerning their own publications.

2.5.9 E-safety, filtering and blocking

All new tools need to be evaluated in a way that pays full attention to their contexts of use. When using Web 2.0 technologies, it has been argued that learners are being drawn into inquiry methods that are more collaborative and less solitary, and a recurring concern is the risk that might be attached to extensive online communication. These concerns primarily regard students communicating with predatory strangers and being bullied by their peers. There had been much research about online dangers (Wolak *et al*., 2008) and one UK study by Smith *et al*. (2008) pursues the issue of cyber-bullying with large samples of secondary pupils. There is no doubt that many young people have been victim of this kind of persecution through participating in Web 2.0 activities (Li, 2007; McKenna, 2007; Stomfay-Stitz and Wheeler, 2007). Even if these problems are less frequent than feared, they still arise and so e-safety must be an important factor when considering the implementation of Web 2.0 technologies.

Local Authorities may choose to block access to certain sites to prevent students from accessing them from school. Crook *et al.* (2008) found that, although:

> *"58% of teachers surveyed wanted tighter internet controls; many teachers also reported frustration at being unable to access websites due to RBC/local authority and/or school filtering systems."*
>
> (Crook *et al.,* 2008, p.9)

This is certainly true for some local city schools, including that of the researcher, which do not have access to Facebook, Glogster and many other Web 2.0 tools. From the researcher's own experience, the LA often states that sites have been blocked because educators have requested it, although this does not prevent staff from complaining about lack of access. On occasion, sites, for example YouTube, may be able to be accessed by staff rather than students, which allows them to be used in lessons, if not by all. There is some evidence that blocking or filtering on a school level is not always understood by staff, indicating that teachers need to find out if it is possible to unblock web tool sites before attempting to use them in lessons, but also to not assume that all Web 2.0 tools will be 'banned' in school.

Byron (2010) and Ofsted (2010) both agree. Byron, in her report, states:

> *"There is a growing acceptance that simply blocking children and young people's access to the internet in schools is not an effective way to keep them safe and increase their resilience. In its recent report 'The safe use of technologies', Ofsted found that where schools 'locked down' the internet, making many sites inaccessible, this did not encourage children and young people to take responsibility for their own safety. Instead it*

> *meant that they weren't able to access a range of sites that are beneficial for learning, and that they were less likely to develop the understanding of digital safety that they needed to be digitally safe outside of school."* (p.16)

Educators must, therefore, not be afraid of allowing students access to Web 2.0 tools, but must first teach them how to use the webtools safely, inform them of the publicity of their work, both the benefits and the risks involved with using the webtools and what information must not be shared over the Internet.

In addition to cyber-bullying worries, practitioners (Crook *et al.,* 2008) were also concerned about the privacy or safety of passwords, the use of public forums and if children were traceable. Others may be worried about students using the web tools inappropriately. As this will sometimes occur, particularly in schools which have opted for less control, the key is to ensure that members of staff have an informed view of the risks and schools have appropriate strategies in place. It is important that educators are familiar with their school and LA's e-safety policy and that their students are not placed in danger when using web tools at school. Simple remedies may include not uploading photographs with names to websites and wikis, using initials rather than a full name on an etherpad and ensuring that parents have given consent to images being posted on school websites.

Most wikis can be controlled so that students can only post to certain pages, and they can be assigned a username and password to prevent the general public from commenting on them. The collaborative nature of wikis may lead to any instances of inappropriate behaviour being discovered quickly and as revisions are logged, perpetrators are traceable.

IT technicians often perceive that they spend a substantial amount of time policing Internet use, which may ultimately impact on time that could be spent supporting new technologies. Instead, schools should opt to teach students how to be responsible online, ensuring that they are well informed about the issues of audience, purpose and context. It is also worth noting that teachers may also be victims of cyber-bullying, which can cause great distress. The UK government has recently made cyber-bullying (linked to its Behaviour Policy) a priority area. The DfE website (2013) states:

> *"The wider search powers included in the Education Act 2011 give teachers stronger powers to tackle cyber-bullying by providing a specific power to search for and, if necessary, delete inappropriate images (or files) on electronic devices, including mobile phones."* (p.2)

Fear of cyber-bullying in itself may prevent some teachers from wanting to use web tools in their lessons. However, if teachers find out how to control and manage these technologies and have an appreciation of how to ensure comments remain traceable and open, some of their concerns may be eased.

2.5.10 Development of the infrastructure

There are a few infrastructure considerations to take into account with regards to implementing Web 2.0 technologies in schools. Firstly, as managing multiple passwords can be difficult for students and time consuming for technicians, it may be worth considering how students log on to sites. A single sign-on was seen as an advantage in the study by Crook *et al.* (2008), who also indicated that a potential barrier was accessing multiple resources separately. Some schools overcome this issue by hosting everything on their VLE but as some Web 2.0 content, such as podcasts may benefit from wider publication, schools must consider whether this is in their best interests. Schools must also choose how much autonomy to retain as regards implementation of the technical infrastructure needed for Web 2.0. In-house expertise may make tools which are more specific to the needs of the school but a greater amount of functions and capabilities may be afforded by external services. Unfortunately, hosting VLEs externally may also lead to bandwidth issues. One Humanities lecturer is reported as having said:

> *"I found out all my students were looking at the material in the VLE but going straight to Facebook to use the discussion tools and discuss the material and the lectures. I thought I might as well join them and ask them questions in their preferred space."*
>
> (Anderson, 2006, p.34)

Clearly, when developing the infrastructure, it is vital to conduct a pilot study before assuming that students will naturally use the webtools in the way the teacher desires.

2.6 What standards and policies relate to Web 2.0 Technologies?

There are some attractions to embracing Web 2.0 technology in the classroom, other than the recognition that students are likely to be familiar with these technologies. There is also a match with current overarching policy and curriculum goals. The previous UK government stated that:

> *"We want to do more to exploit the educational potential of the new technologies…[our priority] is to do all we can to accelerate the move to the next generation of e-learning activities and resources."*
>
> (DfES, 2005, point 11)

Cultivating collaborative, personalised learning and engaging less enthusiastic students are both stressed. They suggested learners would be spending more time working in groups and other learners, being creative. Clearly, policy for the incorporation of ICT in education was in step with the affordances of Web 2.0 activities. The more recent Conservative government released a new National Curriculum framework in 2011.

The statements below are those which relate to the use of ICT in science (DfE, 2011):

- There are a number of key concepts that underpin the study of science and how science works.
- Pupils need to understand these concepts in order to deepen and broaden their knowledge, skills and understanding.
- Sharing developments and common understanding across disciplines and boundaries.
- Pupils should be able to:
  a. use appropriate methods, including ICT, to communicate scientific information and contribute to presentations and discussions about scientific issues.
- Wide range of primary and secondary sources: Primary sources such as data logging and secondary sources such as the Internet are essential aspects of pupils' experience of science.
- Use appropriate methods, including ICT, to communicate scientific information: For example, digital photography, video or podcasting as alternatives to text-based approaches.

It is worthy of note that Web 2.0 technology was specifically mentioned in the 2007 National Curriculum, highlighting its current importance in the future of science education, but is absent from the proposed 2014 Computing Programme of Study (DfE, 2013). What is also interesting is that any mention of ICT skills has now been removed from the 'Teachers Standards' (DfE, as of 6th December, 2012). Perhaps it is now assumed that teachers will have the necessary ability in the use of new ICT technologies? Regardless, it is vital that teachers keep abreast of new developments in their field, including technological advancements, regardless of what is written as teachers' standards.

2.7 Summary

So is computer-based learning more effective than learning in a traditional classroom? The question may be irrelevant for those who see technologies as tools for teachers and not as substitutes. Also as most of these systems are intended not simply to reproduce the classroom environment 'on-line', but to use the technology to provide learners with new tools to facilitate their learning, perhaps we should establish if educational programmes are effective, without comparison with teachers, simply by comparing what the learners perceive that they know before and after? Do learners feel that they make *progress* when using Web 2.0 Technologies to generate their own web content? This subject will form the basis of this research study and it will be investigated in the next sections. The next chapter discusses the research design and methodologies used in this study.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The following chapter describes the design of the research, including the methodology, and is followed by a linking chapter concerning the actual methods used, in which there is an account of the experimental and control conditions through which the hypothesis has been tested. In this chapter, the methodological approach that has been taken is described and defended.

Figure 3.1 overleaf illustrates the structure of this chapter:

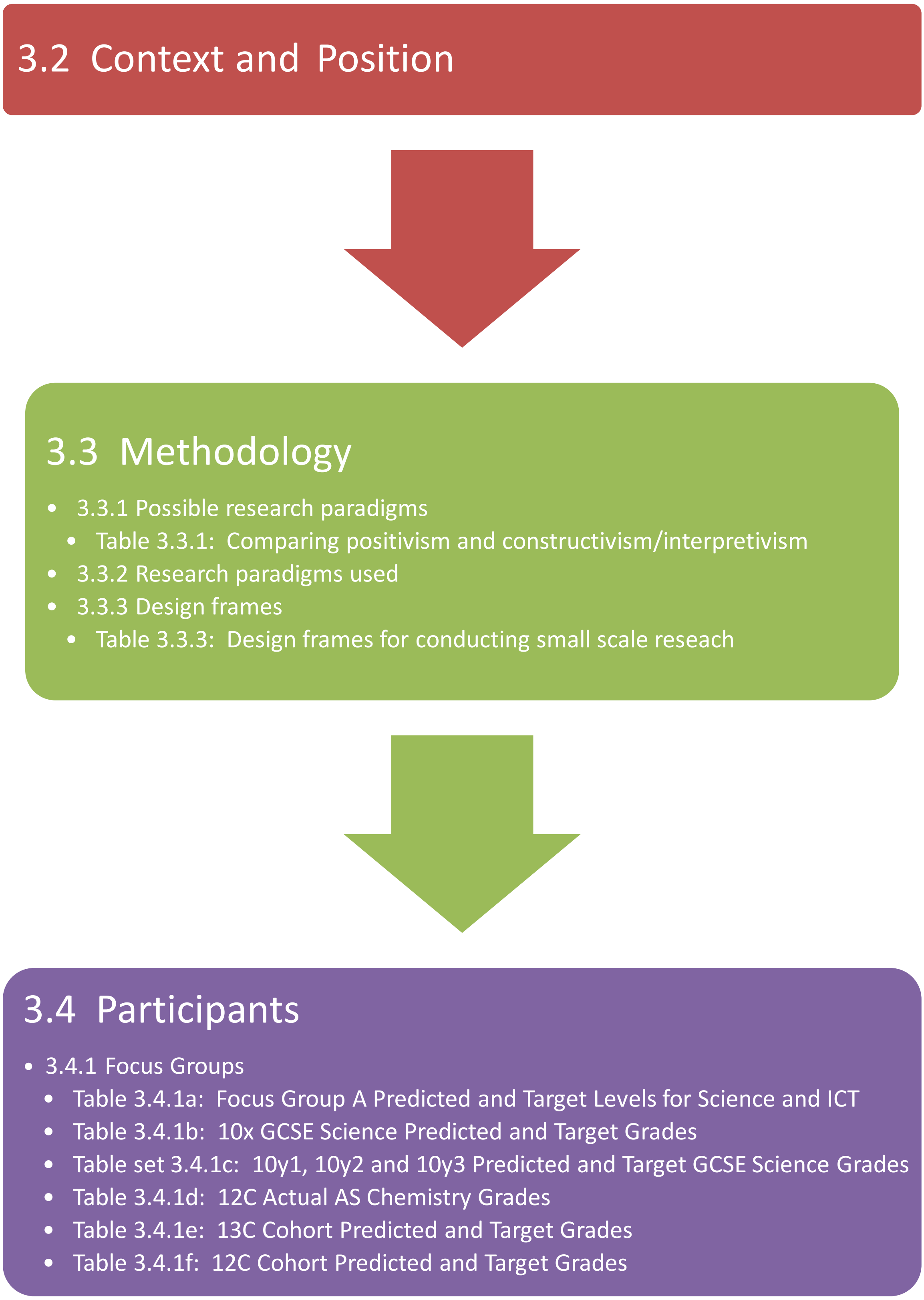

Figure 3.1: Outline of the Research Design and Methodology Chapter

3.2 Context and position

This chapter will focus on the rationale and methodology developed to answer the research questions postulated in Chapter 1. The researcher, a white, British, 31 year old woman, had worked as a Science, specifically Chemistry, teacher for 8 years, in an inner city school and sixth form college, in the East Midlands.

According to Ofsted (2009) the proportion of students in this school who were from a minority ethnic group was higher than nationally as was the proportion that had English as an additional language. The proportion of students who had special educational needs was in line with the national average, as was the proportion that had a statement of special educational needs. A smaller proportion than nationally were eligible for Free School Meals (FSM). The Principal took up his post in 2007.

According to Ofsted (2012), in 2012, 68% of all pupils at the school attained five GCSEs grade A* to C including English and Mathematics and this was in the top 40% of both similar and all schools' results. Attendance (95.8%) had increased since 2011 and was in the top 20% of all schools. 83% of all pupils attained grade A* to C in English and 85% of all pupils achieved expected progress, and this was in the top 20% of both similar and all schools' results. 69% of all pupils attained grade A* to C in Mathematics but this result was in the bottom 40% of similar schools' results, and in the middle 20% of all schools' results. 69% of all pupils achieved expected progress in Mathematics but non-disadvantaged students performed better. 82% of pupils entered attained grade A* to C in science which had decreased from 89% in 2011 but the school's result was still in both the top 40% of similar, and all schools' results.

To provide some further context, and as explained in the introductory chapter, at the start of this research, the school in question did not have a Virtual Learning Environment as their previous subscription to the VLE package, Fronter, had not been renewed due to cost issues. The researcher had then sought to develop her own practise with relation to the use of ICT, and specifically free webtools, in the classroom by investigating the use of Web 2.0 tools in teaching and learning. The purpose of this study, therefore, was to find out secondary school students' perceptions of using ICT based teaching tools and Web 2.0 tools in science lessons.

It was essential when planning that the school's eSafety policy was considered. All Internet activity on the school's network was logged by the school's Internet Service Provider (ISP) and these logs may have been monitored. A breach or suspected breach of policy by a School employee, contractor or student may have resulted in the withdrawal of School ICT hardware, software or services as any policy breach is grounds for disciplinary action in accordance with the school's disciplinary procedure. Both the members of staff and students involved in this study all signed an acceptable use agreement on joining the school, which included the following relevant statements:

- Staff will preview any recommended sites before use
- All users must observe copyright of materials from electronic resources
- Staff should not reveal names of colleagues, customers or clients or any other confidential information acquired through the job on any social networking site or blog
- It is at the Principal's discretion on what Internet activities are permissible for staff and students in line with the school's character and educational mission.
- At present, the school endeavours to deny access to social networking sites to students within school
- All students are advised to be cautious about the information given by others on sites, for example users not being who they say they are
- Students are always reminded to avoid giving out personal details on such sites which may identify them or where they are
- Students are encouraged to be wary about publishing specific and detailed private thoughts online
- Staff may only create blogs, wikis or other web 2 spaces in order to communicate with students using the VLE or other systems approved by the Principal

Before planning the tasks it was also important to set out and justify the approach used because, as commented by Yuen *et al.,* (2011):

> *"Using a Web 2.0 technology or tool in the classroom without considering pedagogical theory could be compared to using power tools to construct a house without first consulting an architect."*
> (p.111)

The next section, therefore, considers in detail the possible methodologies, methods and design frames available to the researcher.

3.3 Methodology

3.3.1 Possible research paradigms

There is some confusion amongst researchers about the difference between a research method and methodology. Mackenzie and Walsh (2006) clear this up by saying that:

> *"The most common definitions suggest that methodology is the overall approach to research linked to the paradigm or theoretical framework while the method refers to systematic modes, procedures or tools used for collection and analysis of data."* (p.5)

This methodology section considers then both the paradigms and the design frames. Specifically, this section details the consideration of two different research paradigms: Positivism; and Constructivism, sometimes referred to in the literature (Thomas, 2009) as Interpretivism. Positivism is often characterised by quantitative approaches and constructivist perspectives are often used to provide explanations of qualitative data. This suggests that there are many, and changing, truths which arise from the participants' and researcher's understanding of reality. To analyse the nature of these approaches there must be an understanding of the types of research question asked, methods used and knowledge produced.

Positivism states that truth is independent of human thought and action and science measures and analyses the relationship between the experimental variables in the quantitative study (Cohen *et al.,* 2011, p.7). These studies often may use large samples and employ statistical methods, and are used to make generalisations and predictions. Positivism has also been referred to in the literature (Enonbun, 2010) as objectivism, and this:

> *"…suggests that the instructor is the expert and sole custodian of information and knowledge and for learning to take place, the instructor has to actively engage in transferring the knowledge in a highly structured and planned manner. This*

> *implies that the learner neither has control over the pace of knowledge transference nor influence on the content being transferred."* (p.21)

This does not seem to provide a good fit with the concept of e-learning or student generated content, where a vital aspect is how the student learns from others via electronic media. Perhaps a better paradigm for this topic is that of constructivism or interpretivism, which in many ways is the converse of positivism and:

> *"…proposes that the learner actively participates in the learning process…It assumes the fact that the individual learner takes active responsibility of the content of the material being learnt, the learning process, as well as the manner of instruction."* (Enonbun, 2010, p.21)

This appears to be a better match with both e-learning and student generated content. Indeed, Koohang et al. (2009) agree that this paradigm is a good fit for e-learning because it ensures learning among learners. Enobun (2010) also advocates the constructivist approach with regards to research concerning the Internet, stating that it will:

> *"…open new avenues for learning as well as challenges for the instructor trying to implement it in the Global realm because the constitution of the emerging classroom will provide any instructor the opportunity to stimulate learners to construct their own learning irrespective of cultural inclinations. Moreover, regardless of geographical location, the internet is a unifying and flexible platform that can be harnessed to facilitate learning."* (p.24)

The table overleaf compares these two paradigms:

Paradigm	Positivism	Constructivism/Interpretivism
Overriding goal(s)	Prediction and explanation	Understanding
The social world is...	able to be studied objectively and exists beyond the human mind	constructed intentionally and knowledge is everywhere
The researcher and reality are…	separate	inseparable
The researcher aims to be…	independent, an outsider	an insider, interacting with participants
Methods used are…	survey, experiment and structured observation	unstructured observation, case study, unstructured interview, and participant observation
Generalisations	General accounts inform the specific	Specific accounts inform each other
The research object…	has inherent qualities that exist independently of the researcher	is interpreted in light of the researcher's experience
The researcher's own value position should be…	removed from the process	taken into account in the process
The researcher looks at…	things that can be quantified and counted	perceptions, feelings, ideas, thoughts and actions as heard or observed
The researcher analyses…	variables, decided on in advance of fieldwork	emergent patterns
The research design is…	fixed	flexible

Table 3.3.1: Comparing positivism and constructivism/interpretivism; adapted from Thomas (2009).

The differences between these paradigms may be evident; however, pragmatists question the separation of these two paradigms and call for a union of quantitative and qualitative methods because they share many commonalities in their approaches to inquiry (Feilizer, 2010). Cohen *et al*. (2011) go on to define pragmatism as being practice-driven; that there may be both singular an multiple versions of reality; that reality is objective and socially constructed and that it adopts a pluralistic approach, drawing on both positivist and interpretive epistemologies. The research is driven by the (numerous) research questions and often the research design is set up so that the integration of qualitative and quantitative data is assured.

3.3.2 Research paradigms used

In this section, the methodologies of the research study are laid out, with reference to the paradigms described in the previous section. The constructivist or interpretivist approach fitted well with this study as it tends to rely upon the "participants' views of the situation being studied" (Creswell, 2003, p.8) and the researcher was able to recognise the impact on the research of their own background and experiences. The constructivist researcher is most likely to rely on qualitative data collection methods and analysis or a combination of both qualitative and quantitative methods, known as mixed methods, where quantitative data may be used to support or expand upon qualitative data, to deepen the description. Chan and Ridgway (2006) also found that:

> *"Social-constructivist principles predict that students' construction of knowledge will be enhanced if they engage actively in the co-construction of knowledge with peers, and with their tutor."* (p.2)

This suggests that this paradigm was a good fit with the research question concerning student-generated content. However, Cohen *et al.* (2011, p.23) state that: *"Mixed methods approaches are premised on* pragmatism *ontologies and epistemologies"* instead of constructivist.

Thus the methodologies used in this research may be thought of as either based on pragmatism or constructivism/interpretivism, or indeed both. This is because even though a mixed methods approach has been used, the research questions in this study stem from a desire to understand students' perceptions and thus, from an interpretivist or constructivist paradigm.

3.3.3 Design frames

The design frame provides the framework for the research. Thomas (2009) states that the seven most common structures used in small scale research are case studies, comparative research, action research, ethnography, evaluation, experiment, and longitudinal or cross-sectional study or survey. The table below details the purposes of five of these design frames:

Model	Purposes
Survey	Gathering large scale data Making generalisations Gathering data able to be statistically manipulated Gathering context-free data
Experiment	Comparing under controlled conditions Generalising about efficacy Objective measurement Establishing causality
Ethnography	Portrayal of events in subjects' terms Subjective and reporting of multiple perspectives Description, understanding and explanation of a specific situation
Action research	Plan, implement, review and evaluate an intervention designed to improve practice or solve a local problem To empower participants through research involvement and ideology critique To develop reflective practice and promote equality democracy To link practice and research and promote collaborative research
Case study	To portray, analyse and interpret the uniqueness of real individuals and situations through accessible accounts To catch the complexity behaviour To contribute to action and intervention To present and represent reality

Table 3.3.3: Design frames for conducting small scale research, adapted from Cohen *et al*. (2011, p.129)

Experiment was not a possible design frame due to the subjective nature of the research and survey could not be used because data were not able to be gathered on a large scale and was unlikely to be context-free. Ethnography involved the teacher as a participant and was not thought to be the best fit. A possible design frame for this educational research was 'Action Research'. The action research cycle (below) involves the experimenter continually planning and taking actions then critically reflecting on the outcomes of those actions.

Figure 3.3.3: The Action Research Cycle (based on Cohen *et al.,* 2011, p.354)

A specific example of action research is "*practitioner research*" (Fox *et al*., 2007, p.81) which is carried out by practitioners for the purpose of reflecting on and ultimately advancing their own practice. Although this study could be thought of as a series of case studies, the actual design frame involved in this research took the form of this action (practitioner) research. This allowed for many webtools to be evaluated, whilst giving the researcher options on how to proceed further into the study, in order to improve teaching and learning in the school. As the researcher found out about new webtools, she was able to plan them into the research, trial them with a Focus Group and then use the data generated to inform the next stage of the project. For example, the Kerboodle website used with Focus Group A was then trialled with Focus Groups B and C after the lesson was deemed to be successful, to see if the other groups had similar experiences. Similarly, the etherpads were trialled informally with Focus Group D to highlight any technology-based issues that Focus Group A may go on to experience during their lesson.

3.4 Participants

This section reviews the targeted population and participants in the study. A detailed description of the tasks assigned to each group can be found in the Methods section. For ease of data interpretation, each class or group involved in the research has been referred to as a “Focus Group” and there are 5 such groups involved.

In this study, it was thought that the greatest impact could be gained from sampling participants around the transition points between the Key Stages. However, it was decided that it would be neither practical nor productive to ask Year 11 students to participate in the study until they had completed their General Certificates of Secondary Education examinations (GCSEs) as it was felt that students may not want to focus on anything other than their studies at this time and also any follow up questions may prove difficult if the students did not stay on in the sixth form. The selection of Focus Group E allowed for the Key Stage 4 to 5 transition point to be investigated whilst still overcoming this problem.

3.4.1 Focus Groups

<u>Focus Group A</u>

Focus Group A consisted of 30, Year 9 students, of mixed ability, ethnicity and gender who had one lesson of chemistry with the experimenter every week. Students in this group were between the ages of 13 and 14 when they completed their evaluations. This focus group were introduced to a variety of webtools to gauge their enjoyment, engagement and their perceptions of their learning. These webtools included a wiki to write their own revision page (www.aqascience.wikispaces.com), the use of a commercial package called Kerboodle (which was the only paid for service used in this study) to complete revision activities, and the students also completed a series of lessons using etherpads and corkboards (www.9sherwin.yolasite.com; www.year9.yolasite.com) in collaboration with two ICT Postgraduate Certificate of Education (PGCE) students from an East Midlands university, and their mentors. The participants were then required to complete short evaluation questionnaires.

All students agreed to participate and the numbers who completed the questionnaire reflect the number of students who attended those particular lessons as these evaluations immediately followed each lesson. 28 students completed the wiki evaluation, 27 students completed the Kerboodle evaluation, all 30 students completed the etherpad and corkboard evaluation and 26 students also completed the voluntary ICT questionnaire towards the end of their course. The questionnaires were completed at the end of the lesson and were designed to take less than 10 minutes to fill in.

Participants in Focus group A were selected to represent Key Stage 3. They were the oldest Key Stage 3 group the experimenter taught and this was thought to be the most appropriate group for the study as the participants were of mixed ability (according to Fisher Family Trust (FFTD) target levels), ethnicity and gender, and good follow up in Key Stage 4 would be possible with this group as it was likely that the experimenter would continue to teach the students when they moved into Year 10. As the researcher had easy access to this group, this was a convenience or opportunistic sample and making generalisations to a wider population is not recommended (Cohen et al., 2011). However, as this class is a mixed ability group, some generalisations to the whole of the Year 9 cohort may be able to be made. Target levels for Science and ICT, along with their attained levels are displayed in the table:

Initials	Gender	KS2 Science	FFTD Science Target	Assessment A	Assessment B	Assessment C	Reported Science Level	FFTD ICT Target	ICT Assessment A	ICT Assessment B	ICT Assessment C	Reported ICT Level
CA	M	5C	7C	6A	7C	6A	6	6B	5A	5A	6C	6
AB	F	5C	7C	6A	6A	6B	6	7C	6A	6A	6A	6
EB	F	4B	6B	6A	6A	6C	6	6B	6B	6B	6B	6
TC	M	Student joined late				6C	6	Student joined late			5C	5
MC	M	4B	6B	6A	6A	6A	6	6A	6C	6C	6C	6
CD	F	5C	7C	6B	6A	6B	6	7C	5C	6C	5C	5
DF	M	5B	7B	7B	7B	7C	7	7B	6A	6A	7B	7
GG	M	4C	6B	6A	6A	6B	6	6C	5B	5B	5A	5
RH	M	6A	6B	6B	6B	6C	6	6B	5B	5B	5B	5
CH	M	5B	7B	7B	7B	7B	7	7C	6A	6A	6A	6
AK	F	5C	7C	7C	7C	7C	7	7C	6B	6B	7C	7
RK	M	5A	7A	7B	7B	7C	7	7A	7C	7C	7B	7
CM	F	4B	6A	7C	7C	6A	6	6B	6B	6B	6B	6
JM	M	5A	7A	7B	7B	7B	7	7A	7C	7C	7B	7
DO	M	3A	5B	5C	5C	4A	4	5A	5C	5C	5C	5
KO	M	5B	7B	7B	7B	7C	7	7B	6A	6A	7B	7
EO	M	3A	6C	7C	6A	6B	6	5A	5B	5B	5B	5
DO	F	4A	6A	6C	6C	6C	6	5A	5A	5A	5A	5
EP	F	5B	7B	7C	7C	7B	7	7B	6B	6B	6B	6
JP	F	4A	6A	6A	6A	6C	6	7C	6A	6A	6A	6
MP	F	5B	7B	7C	7C	6A	6	6A	6A	6A	6A	6
TP	F	4C	6A	6A	6A	6A	6	6C	6C	6C	6B	6
RR	F	5C	7C	7C	7C	6A	6	6A	6B	6B	6A	6
CS	F	5B	7B	7B	7B	6A	6	6A	6A	6A	6A	6
ES	M	3B	5B	5C	5B	5B	5	5A	5B	5B	5B	5
DT	F	4B	7C	6A	7C	6A	6	6B	6B	6B	6A	6
GW	F	5C	7C	7B	7B	7B	7	7C	6A	6A	6A	6
MW	F	4B	6B	6A	7C	6A	6	6C	7C	7C	6A	6
VW	F	5B	7B	7C	7C	6A	6	6A	6A	7B	6A	6
PY	F	4B	6B	6A	6A	6B	6	6C	6A	6A	6A	6

Table 3.4.1a: Focus Group A Predicted and Target Levels for Science and ICT

For the tables in this section, red indicates that the student has a predicted grade or level below their target grade. Yellow indicates that the student is achieving their target level or grade, and green indicates they are exceeding their target level or grade.

Focus Group B

Focus Group B was an opportunistic sample of 17 students from a middle set Year 10 X-band (one half of the year group) class. At the time they were revising for their January GCSE science examinations and it was thought that there was a good opportunity to investigate the impact of webtools on revision. This class completed some revision lessons using a teacher-made website (www.year10science.yolasite.com) and evaluated the lesson afterwards. 12 students in this focus group also completed an ICT questionnaire at the end of one of the lessons. The lessons occurred prior to their January examination. This was purely a small opportunistic sample group (sometimes referred to as a convenience sample, for example, by Cohen *et al.,* 2011) but it is included in the study due to the clear impact the webtools had on the behaviour of this (in the researcher's opinion) challenging group of students. Their predicted and FFTD target grades are in the table below:

Gender	Science TMG	Assessment A	Assessment B	Assessment C
F	A	B	B	D
M	B	D	F	F
F	B	C	D	D
F	C	D	D	D
F	C	C	C	C
M	C	C	D	D
F	C	E	E	E
M	C	C	C	D
F	D	D	D	D
M	D	C	D	D
F	D	D	C	C
F	D	F	E	E
M	E	E	E	E
M	E	E	E	E
F	B	B	C	D
F	B	B	B	B
F	C	C	C	C

Table 3.4.1b: 10x GCSE Science Predicted and Target Grades

Focus Group C

Focus Group C was comprised of 27 Year 10 Y-band students which were sampled from a total of 70 students taking GCSE science in this band. This was a sample size of 40% and this equated to 9 students in each of the three (top, middle and bottom set) classes. All students first completed the same lesson and then a random number generator was used to select the students from an alphabetical class list. All of the students in these classes completed a series of revision lessons using the commercial Kerboodle package, and each lesson was followed by asking the randomly selected 9 students in each set to complete a questionnaire at the end of the lesson so their thoughts were fresh in their minds. Students in these classes also developed the www.aqascience.wikispaces.com wiki and gave open, verbal feedback in an evaluation session following the Media activity.

Focus group C was the only group in which it was possible to sample students from a wider cohort. The random number generator allowed for a random sample to be selected from each group and provided a mixed ability, gender and ethnicity group. It was thought that it was necessary to sample students from each set in case there were any factors that had changed in each lesson, such as technology issues that were present in one lesson but not another. This is also the reason why 9 students were selected from each class, rather than a representative sample from each class based on group size. It may now be possible to make some predictions as to the opinions of the whole Year 10 cohort but generalisations should not be made to a wider population as the group size is still small. The tables below show the predicted and target GCSE Science grades from all the students in Year 10 Y-band.

Gender	Science TMG	Assessment A	Assessment B	Assessment C
M	A	A	A	B
M	A	B	B	B
F	A	B	B	C
F	A	B	B	D
M	A	D	B	C
M	A	A*	A	B
F	A	A	A	C
F	A	B	A	B
F	A	B	B	C
F	A	B	B	B
M	A	A	B	B
M	A	B	B	B
M	A	B	B	C
M	A	B	B	B
F	A	A	A	B
F	A	B	C	C
M	A	C	B	C
M	A	C	B	C
M	A	A*	A	B
M	A	B	A	B
F	A*	A*	A	A
F	A*	A	A	B
F	A*	A*	A*	A
M	A*	A	A	A
M	A*	A	A*	B
M	A*	A*	A*	B
M	A*	A	A	B
F	A*	A	A	A
M	A*	A	A	A
F	B	C	B	C
F	B	C	C	C
M	C	B	B	C

Gender	Science TMG	Assessment A	Assessment B	Assessment C
F	A	B	D	C
M	A	B	B	C
M	A	B	B	C
F	B	C	C	C
M	B	B	C	D
M	B	C	C	D
M	B	B	B	D
M	B	B	C	D
F	B	B	D	D
F	B	C	C	D
M	B	C	C	C
F	B	B	C	C
F	C	C	C	C
F	C	D	D	E
F	C	C	C	D
M	C	B	C	D
F	C	B	C	D
F	C	C	D	D
M	C	C	C	D
M	E	D	C	C

Gender	TMG	Assessment A	Assessment B	Assessment C
M	B	D	D	E
M	C	D	D	D
M	C	D	C	D
F	C	C	C	D
F	C	D	D	E
M	C	C	C	D
M	C	C	C	D
F	C	C	D	E
F	C	C	D	D
F	C	C	C	D
M	C	B	D	E
M	D	C	D	D
F	D	D	D	D
M	D	D	D	D
M	D	D	D	D
M	D	D	D	D
F	E	E	E	E
M	E	E	E	E

Table set 3.4.1c: 10y1, 10y2 and 10y3 Predicted and Target GCSE Science Grades

Focus Group D

Focus Group D consisted of sixteen Year 12 students, of mixed ability (students had gained grades A*–C in GCSE Core and Additional Science although had targets grades of A–E), ethnicity and gender, who attended two, one-hour lessons with the researcher every week. Students in this group were aged between 16 and 18 when they completed their evaluations. This group investigated the impact of a variety of webtools including a wiki for writing up experiments (www.labbookonline.wikispaces.com), a website which acted as a temporary Virtual Learning Environment (www.emschemistry.yolasite.com), and an exercise in creating and maintaining their own website using a free, online website developing and hosting webtool called Yola, (catalogued on www.chemhub.yolasite.com). The group also tried using some etherpads (openetherpad.org) before introducing it to Focus Group A. All students in Focus Group D completed an ICT questionnaire and a survey about their perceptions of the webtools at the end of the course. Some students who were absent when the questionnaires were given out at the end of Year 12 completed them at the start of Year 13 instead so that the whole group was surveyed.

Focus Group D was comprised of the entire Year 12 Chemistry class of 2012 at the school. These 16 Year 12 students were chosen rather than Year 13 for the same reasons as for Focus Group C; it allowed for more opportunities for follow up questions and interviews. This was particularly important as the development and assessment of the webtools was viewed to be a lengthy process which may have required data collection to occur at the start of the group's A2 studies if time had not permitted for this during their AS levels. This group achieved the following grades at AS level:

Grade	A	B	C	D	E	U
Number of students	2	2	5	2	3	2

Table 3.4.1d: 12C (2012) Actual AS Chemistry Grades

8 of these students continued into Year 13 to study A2 Chemistry. Their target grades and predicted grades at the three assessment points are displayed in the table:

Initials	Gender	TMG	Assessment A	Assessment B	Assessment C
KH	M	C	C	B	C
EL	M	C	E	D	D
SN	F	A	C	B	B
JO	F	B	B	B	B
CP	F	C	C	C	B
AS	F	C	D	D	D
CT	M	B	C	B	C
MW	M	A	A	A	A

Table 3.4.1e: 13C (2013) Cohort Predicted and Target Grades

5 of these students agreed to take part in a small group interview concerning the student-generated websites; the transcript of this interview can be found in the Appendix 11.

Focus Group E

Focus Group E was comprised of a group of 19 Year 11 students who had indicated that they intended to study a science subject in Year 12. The sample was opportunistic as the AS Chemistry class of 2013 was the only group to which the researcher had access. Focus Group E was initially set up to provide some information for a pilot study concerning a Bridging the Gap project, organised by a 13-19 Education Support Agency, based in the East Midlands. A bridging the gap project was introduced in the school in July, 2012 as an optional activity for prospective Year 12 science students in Chemistry, Physics, and Biology to complete over the 2012 summer holiday. In September 2012, 19 students began their Advanced Supplementary (AS) Chemistry course. This group were mixed in ability (students had gained grades A*–C in GCSE Core and Additional Science although had AS Chemistry targets grades of A–E), ethnicity and gender. They were asked to complete a short evaluation during one of their first Chemistry lessons to find out how many students completed the bridging project and how they felt it would affect their learning. The 19 students in the AS Chemistry group all completed the evaluation and all work was taken in, marked and returned. The target grades and predicted grades at the three assessment points are displayed in the table:

ID	Initials	Gender	TMG	Assessment A	Assessment B	Assessment C
184	CB	M	C/D	B	C	C
185	IC	M	B/C	B	B	B
186	ON	F	A	A	A	A
187	BS	M	B	B	B	D
188	JC	M	B/C	B	B	C
189	AM	M	C	D	B	B
190	SW	F	A/B	A	A	A
191	PH	M	C	D	C	D
192	HM	F	B/C	A	A	C
193	SS	F	D	C	B	B
194	KG	F	C	B	C	C
195	KR	F	C	D	C	C
196	MD	F	D	E	Student left course	
197	KJ	M	D	E	Student left course	
198	LS	F	B	B	B	B
199	EG	F	B/C	B	C	B
200	AW	F	B/C	B	C	C
201	AS	F	D	E	E	D
202	EW	F	D	E	Student left course	

Table 3.4.1f: 12C Cohort Predicted and Target Grades

3.4.2 Limitations to the selection of Focus Groups

The selection of the focus groups for this study was mainly due to opportunity. Cohen *et al.* (2011) agree that students often serve as respondents based on opportunistic sampling and also refer to this as convenience sampling, warning that: *"The researcher…must take pains to report…that the parameters of generalizability in this type of sample are negligible."* (p.156) so the results of this study should not be generalised to larger populations but may be used to inform teachers of potential best practice.

As the experimenter is a full time teacher it was thought to be impractical to explore the use of a wide range of webtools and also involve other teachers' groups. It was considered that the collection of data from any groups not taught by the experimenter had the potential to not be conducted fairly by other teachers or there would be a chance of data loss from misplaced questionnaires. All students used in the entirety of this study were taught by the experimenter and therefore all participants had the opportunity to complete questionnaires in class time under quiet, reflective conditions. It was also easy for the researcher to ensure that the ethical considerations discussed were adhered to and all responses were collated and stored securely following the lessons.

All completed questionnaires were stored securely in a locked cabinet in the Science department to which only the researcher had the key (and therefore access). On completion of this report, all questionnaires were destroyed. In addition it is important to note that all completed questionnaires were collected in and handled by the experimenter only. As the researcher was known by all the participants, it is acknowledged that there may be issues concerning bias here. The students may have completed the questionnaires by answering the questions with what they thought the teacher wanted to hear. They may have wanted to impress the teacher, or conversely, they may have felt negatively and spoiled the paper. Similarly in the small group interviewer, the participants may have been reluctant to share their true opinions with the researcher. Therefore caution must be exercised when considering the responses and this is a limitation of this research. Cohen *et al.* (2011) also warn here that:

> *"Respondents cannot be coerced into completing a questionnaire. They might be strongly encouraged, but the decision whether to become involved and when to withdraw from the research is entirely theirs."*
> (p.377)

The researcher ensured that the participants were informed of their right to withdraw before the questionnaires were handed out. Copies of the letter sent to parents and carers, the Informed Consent Form and Participant Information Sheet which clearly state that this is the case for this study, can be found in Appendices 12-14. It is worthy of note that no students who were asked to take part in the study, refused to do so and no students requested that they withdraw at any point. The researcher also received no telephone calls, letters or emails from concerned parents or carers at any point during the data collection or analysis. The next section describes the methods of data collection used in this project in detail.

CHAPTER FOUR

METHODS

4.1 Introduction

In this chapter, the researcher describes the research design and process used in order to collect data to answer the research questions. The methods of data collection that have been used are explained and justified. Also in this section the researcher describes how the quantitative and qualitative data have been collected and triangulated to provide a comprehensive analysis of the research problem. Finally the results of a Pilot Study are described and explained. Figure 4.1a outlines the structure of this chapter:

4.1 Introduction

- Figure 4.1a: Outline of the Methods Chapter
- Figure 4.2a: Methods and methodologies outline of this study

4.2 Possible methods and data collection instruments

- 4.2.1 Questionnaires
- 4.2.2 Interviews
- 4.2.3 Observations
- 4.2.4 Mixed methods

4.3 Methods and instruments

- 4.3.1 Methods used in this study
- 4.3.2 Data collection instruments used in this study

4.4 Tasks

- 4.4.1 Focus Group A
- 4.4.2 Focus Group B
- 4.4.3 Focus Group C
- 4.4.4 Focus Group D
- 4.4.5 Focus Group E

4.5 Data analysis

- 4.5.1 Quantitative data
- 4.5.2 Qualitative data
- 4.5.3 Sampling

4.6 Ethical considerations

4.7 Pilot study

- 4.7.1 Aims
- 4.7.2 Classes
- 4.7.3 Tasks
- 4.7.4 Results
- 4.7.5 Conclusion

Figure 4.1a: Outline of the Methods Chapter

The diagram overleaf (Figure 4.1b) summarises the methodologies, methods, design frame and data collection tools used in this study.

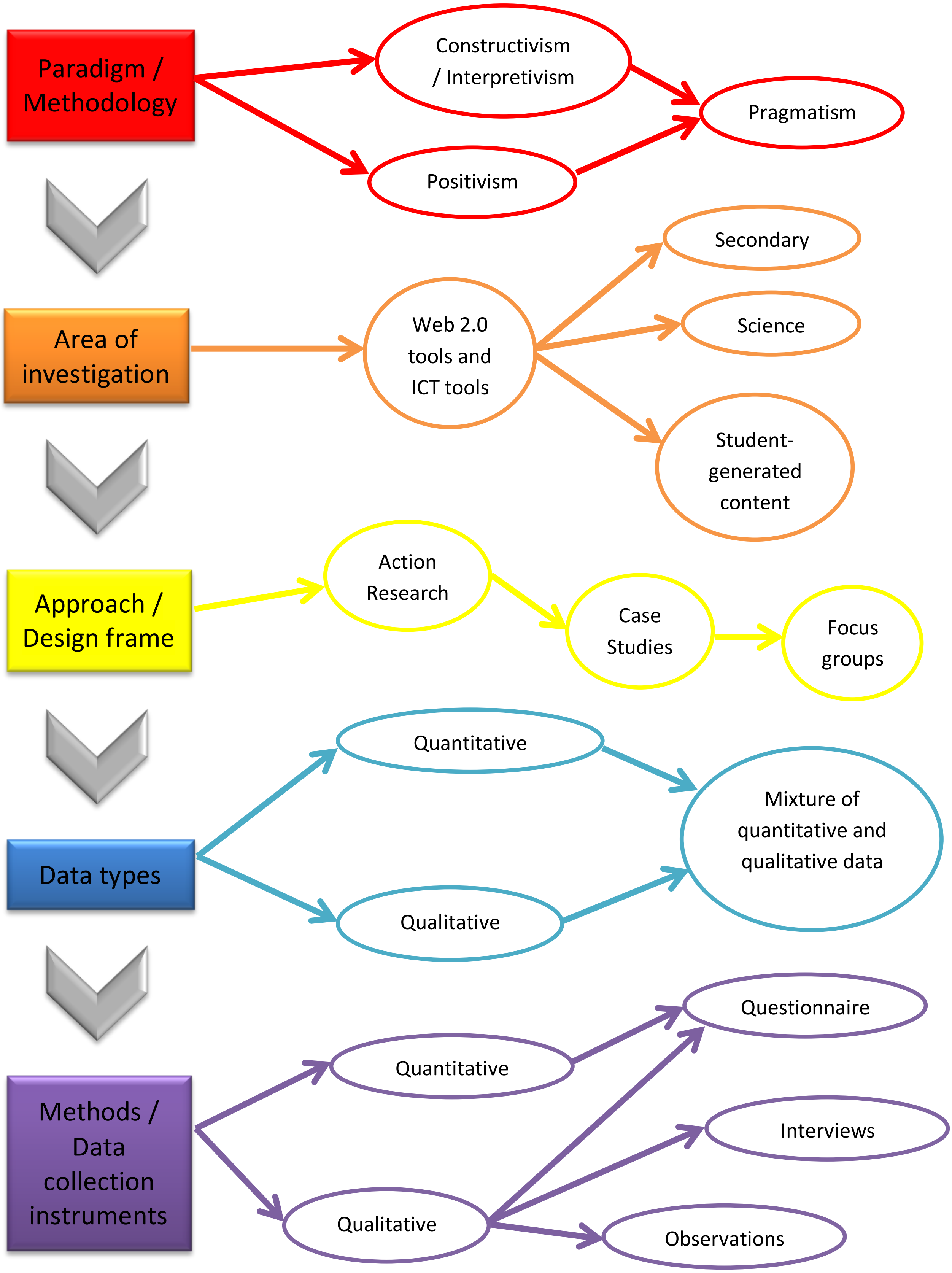

Figure 4.1b: Methods and methodologies outline of this study, adapted from Cohen et al. (2011) and Thomas (2009)

4.2 Possible methods and data collection instruments

In this section the possible methods employed by this study are evaluated. Quantitative studies focus on measurements and amounts of the characteristics displayed by people or events while qualitative studies involve the description of characteristics, organizations, communities, people, and events (Thomas, 2009). Table 4.2 summarises the possible methods and data collection instruments which may have been used in this study:

Method	Advantages	Disadvantages
Survey / Questionnaire	• Good for gathering descriptive data • Can cover a wide range of topics • Relatively inexpensive • Can be analysed with software • Time efficient • Can be anonymous • Possibility of high return rate	• Data may lack depth • May not provide adequate data on the context
Observation (structured, unstructured or participant)	• Provides direct data about the behaviour of individuals and groups • Allows evaluator to enter into the situation • Exists in natural, unstructured, flexible settings	• Expensive • Time consuming • May affect the behaviour of the participants • Observer may not be objective • Observed behaviours may be atypical
Interview (structured, semi-structure, unstructured, group or individual)	• Allows for face to face contact with respondents • Provides opportunity to explore topics in depth • Allows interviewer to explain or clarify questions • Increased likelihood of useful responses • Quickly and easily administered • Can be coded	• Interviewer may influence responses • Interviewee may distort data through recall error • Interviewee may have selective perceptions • Interviewee may have the desire to please interviewer • Clarifications can result in inconsistencies • Volume of information very large so may be difficult to record and reduce
Test	• Provides objective information • Can be made to match a given skill set • Can be easily stored	• May be oversimplified or superficial • May be too complex • May not test knowledge adequately • May be time consuming • May be biased or subject to cheating or coaching
Documents e.g. journals, diaries, accounts	• Available locally • Grounded in the setting and language which they occur • Inexpensive and unobtrusive • Ongoing comparison with previous work	• May be incomplete or inaccurate • Questionable authenticity • Locating documents may be difficult • Analysis may be time consuming • Access may be difficult

Table 4.2: Summary of possible methods and data collection instruments (based on Thomas (2009) and Cohen *et al.* (2011))

4.2.1 Questionnaires

This section comprises of a brief critical and focused review of the literature relating to the methodological issues when using questionnaires. For quantitative studies, questionnaires may be the main tool employed to survey a large population quickly and easily. Questionnaires have been used extensively in the literature. For example, Buzzetto-More (2008) used questionnaires in their research into student perceptions of various e-learning components. Similarly, in their exploration of Web-Based Learning Tools, Kay *et al.* (2009) used a Learning Object Evaluation Scale to survey the teachers involved in their study.

Munn and Drever (1990) state that the four main advantages of using questionnaires are that they are time-efficient, have standardised questions, provide participant anonymity and have the possibility of a high return rate (p.3). However, there are also limitations. The data gathered from questionnaires tend to be descriptive rather than explanative and may also be superficial. Questionnaires may also take a long time to write and trial and if this step is missed, the questionnaire may prove less useful (Munn and Drever, 1990). They may also not answer the questions to which the researcher wants answers and scales may be different from one respondent to the next. For example, a statement that one participant rates as 2 out of 5, another may rate as 1 out of 5, even if the participants actually feel the same. However, with a sufficiently large group, any irregularities may be averaged out.

In interpreting the results of research in which the method involved the use of questionnaires, one commonly used psychometric scale is the Likert Scale. The Likert Scale is a popular format of questionnaire that is used in educational research. It was invented by the educator and psychologist Rensis Likert of Columbia University, primarily for measuring attitudes. Respondents indicate their levels of agreement to statements provided by the researcher relating to that attribute, belief or characteristic. The participant responds to each item on, usually, a five-point scale, although there have been several versions based on the number of points in the scale; the Likert scale can be even, for example, a four-point scale, or odd, such as a seven-point scale. The even numbered scale usually forces a respondent to choose while the odd numbered scale provides an option for indecision or neutrality. Thomas (2009) comments that the: *"…important thing to remember is that you are asking for agreement or disagreement with a statement you provide."* (p.179)

A "Likert scale" is actually the sum of responses to several Likert items. Likert labelled the middle point as "*neither agree nor disagree*" (as did Brodahl *et al*., 2011) and since then, this category has also been labelled "*Neutral*" (Kay *et al*. 2009), "*Undecided*" (Buzzetto-More, 2008), "*U*" (Yuen *et al.,* 2011) or "*no response*" (Hughes and Narayan, 2009) in different studies. Brodahl *et al.* (op.cit.) advocated the use of the five point Likert scale but added the "Don't know" option to their scale. This option, however may give the participants the possibility of 'opting out' and not thinking about their answer sufficiently and so was considered by the researcher to be unhelpful.

More recently, Cohen *et al.* (2011) discussed the issues and advantages of using Likert scales at length; warning that participants may falsify their responses and that reliability may be improved if the scale has a verbal label for each point in the scale, rather than just the end points. They also advise that the end points may be avoided if their labels are too 'extreme' and indicate that there is a tendency for participants to choose the mid-point of odd-numbered scales, which can be avoided by using an even-numbered scale, unless the option for a neutral response is desired by the researcher. They conclude their discussion by stating that: *"A questionnaire might be tailored even more to respondents by including open-ended questions to which they can reply in their own terms and own opinions."* (p.390)

Interestingly, in their study, Brodahl *et al.* (2011) presented their questionnaire findings in terms of gender, and then separately, age, perception of digital competence, estimated digital competence, interest in digital tools, and different educational settings amongst other factors. The researcher considered that it may be interesting to view the results of this study in a similar light and some comparison of age and gender may be useful.

4.2.2 Interviews

Where qualitative responses are to be gathered, the researcher may want to conduct interviews with the participants. In qualitative studies, interviews are often used alongside observational methods at they can *"offer an opportunity to compare researchers' interpretations of what they have seen and heard with those of the participants"* (Murphy & Dingwall, 2003, p.79). Both individual and small group interviews have been used in the literature. For example, Vaughn *et al.* (1996) advocated the use of small group interviews, stating that:

> *"…the interactions between the moderator and respondents and the interactions between the respondents themselves are recognized as having the potential to add depth and dimension to the knowledge gained."* (p.16)

Vaughn *et al.* (1996, p.12) found that small, focus group interviews offer variety and versatility to both qualitative and quantitative research methods. They are also compatible with the qualitative research paradigm, offer opportunities for direct contact with subjects and the group format offers advantages for data collection such as promoting participation and providing another dimension which can yield a great deal of information in a short time. However, Vaughn *et al.* (op.cit., p.145) warn that focus group interviews are dependent on the quality of interactions, the potential for contamination of data is high, subsequent analysis of the data is complex and caution must be exerted when making any generalisations.

Interviews may be conducted individually or in groups. Sample sizes, when using interviews as a method, may be smaller since they are not meant to provide generalisations. Instead of being used for making predictions, the data are used to reveal the behaviour and understanding of the participant groups involved in the study. The data collection methods involved when conducting interviews, for example, transcription of interview questions may also be more labour-intensive, which also limits the sample size. Cohen *et al*. (2011, p.427) advocated the use of group interviews, stating that they:

> *"…are often quicker than individual interviews and hence are time-saving. The group interview can also bring together people with varied opinions, or as representatives of different collectivities."* (p.432)

However they also cautioned that transcribing the interview can pose a significant issue as the researcher may believe that they tell everything that took place during the interview. In addition, like in questionnaires, it may be difficult to completely interpret the exact meaning of the participant responses.

4.2.3 Observations

In qualitative studies, observational methods are often used alongside surveys and interviews. Vaughn *et al.* (1996) comment that this is a good approach as:

> *"…one of the strengths of focus group interviews for research in education and psychology is that individuals are invited to participate in a forum where their diverse opinions and perspectives are desired."* (p.15)

Again, sample sizes may be smaller since they are not meant to provide generalisations. Writing up observations may also be more labour-intensive than questionnaires since they are text-based, which also limits the sample size. Instead of being used for making predictions, the data are used to reveal the behaviour and understanding of the participant groups involved in the study (Vaughn *et al*., 1996)

These methods are open to criticism by positivist researchers because they may be less objective than quantitative approaches and may allow for multiple interpretations of the findings. The researcher must consider this possible bias and also must decide whether lessons should be recorded. Using a video camera may be less biased and allow the data to be analysed more fully. Cohen *et al.,* (2011) agree that:

> *"Audio-visual data collection has the capacity for completeness of analysis and comprehensiveness of material, reducing the dependence on prior interpretations by the researcher."* (p.470)

However, participants may also "act up" for the camera or block the view, intentionally or otherwise. Fixed cameras may not be able to view the whole group in sufficient detail but hand-held camera may cause students to react differently or cause the teacher to not be able to focus on observing the group at the same time. Indeed, there are many limitations to both interviews and observations, as body language, the place where the interview or observation is conducted, and the way in which the interview or observation sequence is started may influence the kinds of answers or behaviours noted. In addition, as an interviewer's (or observer's) goal is to "*conduct an interactive discussion that can elicit a greater, more in-depth understanding of perceptions*" (Vaughn *et al.*, 1996, p.16) rather than to generalise to larger populations, this method of data collection is best used on small groups and the researcher suggests that caution must be used when interpreting results due to this small group size, as a larger group may show a wider spread of opinions.

4.2.4 Mixed methods

The philosophical positions that underpin qualitative methods result in a different epistemological (having to do with knowledge or the theory of knowledge) and ontological (concerning the nature of existence or the kinds of events that exist in the social world) understanding compared to the quantitative approach. However, mixing both qualitative and quantitative methods in the same study is not only possible, but frequently advised. Guba and Lincoln (1994) supported this by commenting that: *"From our perspective, both qualitative and quantitative methods may be used appropriately with any research paradigm."* (p.105)

This mixed methods approach is sometimes also referred to in the literature as "*design frame triangulation*" (Thomas, 2009). Creswell and Plano-Clark (2006) define mixed methods research as:

> *"…a research design with philosophical assumptions as well as methods of inquiry. As a methodology, it involves philosophical assumptions that guide the direction of the collection and analysis of data and the mixture of qualitative and quantitative approaches in many phases in the research process. As a method, it focuses on collecting, analyzing, and mixing both quantitative and qualitative data in a single study or series of studies."* (p.5)

Creswell and Tashakkori (2007) then set out four different realms of mixed methods research:

1. Methods – qualitative and quantitative methods for the research and data types
2. Methodologies – mixed methods as a distinct methodology that integrates world views, research questions, methods, inferences and conclusions
3. Paradigms – philosophical foundations and world views of, and underpinning, mixed methods
4. Practice – Mixed methods procedures in research designs

In terms of practice, using both qualitative and quantitative approaches together may therefore allow for a complementary and robust methodology because the numerical data gathered may be checked against verbal or written qualitative responses. This has been supported in the literature by Kay *et al.* (2009), who, alongside questionnaires, also conducted interviews with their participants so that triangulation was possible. This method supports the approach used in this study. Creswell and Plano-Clark (2006), when discussing the benefits of a mixed methods approach comment that the:

> *"… central premise is that the use of quantitative and qualitative approaches in combination provides a better understanding of research problems than either approach alone."* (p.5)

and therefore also appeared to advocate such an approach. Mixed methods research also does not restrict the researcher when choosing the types of data collection tools and helps to answer the research questions that, the researcher considers, could not be answered by one method alone.

The limitations of this triangulation between qualitative and quantitative responses include the difficulty comparing the results of two analyses using data of different forms. Creswell and Plano-Clark (2006) highlighted that:

> *"It is possible that one form of data collection might introduce bias that would confound the results from the other form of data collected from the same participants. This method may also result in unequal evidence within the study."* (p.120)

It is therefore essential that this is considered when designing the data collection instruments used for each method.

4.3 Methods and instruments

This section includes a summary description of the methods used in this study and how the instruments were designed to be able to collect valid data.

4.3.1 Methods used in this study

A mixed methods approach has been used in this research as it provides strengths that offset the weaknesses of both qualitative research, which is deficient because of the often limited number of participants used and difficulty in generalising findings to a large group, and quantitative research, which does not provide the opportunity for direct quotes from participants. It was hoped that using a mixed methods approach and designing this in from the beginning would allow for more confidence to be placed in the final results obtained even if generalisations cannot be made due to the small number of participants. It was also thought that by using both short answer questionnaires and verbal interviews with classes, this could stimulate a good range of responses and help to answer the research questions.

It is worth remembering here that the research undertaken in this study was to be used to inform best practise. It was important to the researcher that the study did not hinder the students' learning and so some flexibility in terms of the webtools trialled was built in to the study design as the teacher became aware of them, so as to allow for the best possible experience for the students. The mixed methods approach (Cohen *et al.,* 2011) also allowed for the flexibility of the focus groups to be identified by the researcher at different points after her viewing and getting to know the classes. It is important to note that as the study was to be conducted in a school, where timetables can change at short notice, and IT services are not always reliable, it was essential that either the webtools trialled by the focus groups or the number of participants could be changed if necessary, although fortunately this did not occur to any large extent.

Quantitative data were gathered via questionnaires, which as detailed later, also contained statements for the students to evaluate using a five-point Likert scale, for which the mean and standard deviations were able to be calculated. Justifications for using this instrument were discussed earlier in this chapter. Also, in order to establish research trustworthiness, a methodological triangulation was applied as demonstrated in the literature, (for example, Barak *et al.* (2011), used semi-structured interviews and classroom observations), whereby verbal or written responses to open ended questions were matched to similar statements on the questionnaires. This quantitative data were gathered via small group, formal and informal interviews. The small group interview with Focus Group D allowed for expansion upon some of the points raised in the questionnaire and it is without doubt that given more time or resources, the responses gained from smaller group or individual interviews with the other Focus Groups would have been invaluable.

The researcher also had the opportunity of observing all the Focus Groups and so was able to provide observational, anecdotal evidence, taken from her own perspective.

Some reasons given for the quantitative questionnaire data were also able to be explained by analysis of responses to the open ended questions on some questionnaires. When using this mixed methods approach, it was essential that the researcher conducted all data collection with caution and used triangulation to support qualitative and quantitative responses where appropriate. However, the researcher also needed to appreciate that these methods may have been subjected to bias and abuse and therefore any generalisations to the wider population should have been limited.

With regards to the validity of the study, the research methods were designed so that the small number of results produced would reflect the true opinions of the participants at the time. As there was regular contact between the teacher and the focus groups, all participants involved in the study had a large amount of time to give feedback about the webtools they had been evaluating, both formally and informally.

It was thought that with regards to repeatability, if the same study was conducted with students in other departments of the same school, or with similar schools, that similar results could have been produced, but that as such a large number of variables were involved in delivering the lessons, there would still be the potential for great variation in responses. Ideally, a number of schools would have been used in the study to improve reliability, but this was not possible in the time frame available to the teacher.

4.3.2 Data collection instruments used in this study

As indicated previously, both quantitative and qualitative research methods were used in order to gather the first-person perspective of the students on their perceptions of ICT tools and Web 2.0 tools. There was a need to capture the voices and also see if any patterns emerged in the students' perceptions, since they were active participants in the use of this new technology. A mixed methods approach was ideal as it was a type of design in which different but complementary data could be collected on the same topic and the results were then able to be compared and contrasted (Creswell & Plano-Clark, 2006).

In this study, the researcher decided that qualitative data could be obtained from open questions using questionnaires, interviews and unstructured observations as data collection instruments and quantitative data could be obtained from closed questions using questionnaires as data collection instruments. In order to allow for good methodological triangulation, the research questions were considered when designing all the data collection instruments.

Questionnaire design

When designing the questionnaires, advice and guidance from the literature (as previously discussed) was sought and comparisons of other studies were made. Also, the advice given by Cohen *et al.* (2011, pp.386–390) on the advantages and disadvantages of using Likert scales was considered by the researcher and the subsequent tailoring of the questionnaires during the design process was conducted. It was decided that all questionnaires should have an early section which could be completed quickly and easily by the student in order to encourage the student to participate. The questionnaires also then sought to expand on some answers that would have been otherwise asked during interviews, by providing open ended questions towards the end of the questionnaire. Although some students may have not filled in those sections due to lack of time or inclination, it did provide the chance for all students to voice their opinions.

The questionnaires used in the study conducted by Kay *et al.* (2009) were based on a seven point Likert scale. The questions Kay *et al.* used were replicated in this study but the scale was changed to a five point Likert scale of 1 – Strongly Disagree to 5 – Strongly Agree, where students had to make judgements about how much they agreed with a statement. The “Disagree” and “Agree” options were omitted so as to not cause confusion amongst students. It was thought that some participants may fail to distinguish between agreeing, and agreeing slightly, with the statement, for example.

Similarly, many of the questions in both the Webtools questionnaire taken by Focus Group D and the ICT Questionnaire were taken from Buzzetto-More’s (2008) research into student perceptions of various e-learning components, as discussed earlier in this chapter. In this study a similar five point Likert scale was used. However, in Buzzetto-More’s (op.cit.) study, the third category was labelled as “neutral/undecided”. Although Brodahl *et al.* (2011) also included a “Don’t Know” option on their scale, it was decided that this should not be included in the study as it was felt that many students would opt out of thinking about their response should it be an available response option, so this was changed in this study to “neutral” only to encourage students to decide upon a response of some kind.

It was thought that the inclusion of a “neutral” option was necessary as it was felt that there were many scenarios where students would genuinely not have any preference for an answer, and forcing them to agree or disagree, if only slightly, would bias the results. Unfortunately this may have led some students to think less deeply about some responses by merely opting out and choosing 3 – Neutral, instead of making a judgement. It was decided that the label 3 – Neutral was the most appropriate in this study as to not encourage a non-response whilst still providing the option of neither agreeing nor disagreeing with the Likert item. Regardless, the Likert scale used in this study has now been shown to have been supported by many other examples in the literature, including research carried out by Yuen *et al.* (2011), He (2011), and a small study by Deters *et al.* (2010).

As the experimenter had a full teaching timetable, it was considered that there would not be sufficient time to conduct in depth interviews outside of class time, with all groups, so the questionnaires had some open spaces in which students could expand on their answers or add comments, instead. In the literature, Hughes and Narayan (2009) also used a mixture of closed questions, with categorical or scaled responses, and open questions in their research into the use of wikis. Both of these questioning techniques have also been used in this study as they provide an effective method of gauging responses which can be quantified whilst also allowing the participant an opportunity to voice their opinions in their own words.

Questionnaire completion

As all the students only completed the questionnaires in the lessons of the researcher, there was no opportunity to fail to hand in, misplace or invalidate the questionnaires as the teacher could provide an appropriate amount of time and calm environment for the students to record their opinions. The teacher ensured that the participants had time to consider their responses and ask questions if they did not understand what they had to do.

The researcher wanted to avoid “*prestige bias*” (Thomas, 2009, p.174) so explained to the students that their responses were anonymous if they wished. It was possible that the students would be biased towards the researcher and try to select the ‘right’ answer or an answer which they thought would impress the teacher. Thomas (op. cit., p.175) advises here that the researcher should not just tell people that the questionnaire is anonymous, but make it clear how the anonymity is to be achieved and respected. Participant information letters were therefore given to every student who may have taken part in the research. A copy of this letter and information sheets can be found in Appendices 12-14. The researcher was also able to ensure that she did not encourage the students towards a particular response by stating that the student should chose the response that best suited how they felt, but otherwise no help was given to students when filling in questionnaires.

Interview question design

Although there were quantitative aspects to this study, there were also many qualitative elements. In whole class interviews, students were asked to comment on their experience of the webtools they had evaluated. The interview questions were noted down beforehand and written notes were taken of the responses, which were then typed into this report. When the interview questions were written down, the researcher checked that the participants were encouraged to give an extended response. For example, closed questions such as "*Did you enjoy using the wiki?*" were rephrased to an open question such as "*How do you rate your enjoyment of using the wiki?*" to promote a discussion of how much the class enjoyed the lesson. It was thought that closed questions might encourage participants to agree with what they perceived was the "correct" response; what they thought the teacher wanted to hear.

The interview questions were amended after analysis of the questionnaire data to allow the researcher to probe deeper into some responses form the questionnaires that she felt required further explanation.

Conduction of interviews

In all cases where interviews had been conducted, the group sizes were small enough to conduct a class discussion, so no sampling as such was required. Before asking any group questions it was made clear that there were no right or wrong answers and students were encouraged to let the teacher know their true opinion as previously advocated by Cohen *et al.* (2011). When asking questions, the researcher ensured that the tone and phrasing of the questions did not lead the participants towards a particular response.

To conclude, both the methods and the data collection instruments used in this study have been used extensively by others in the literature and it was considered that these methods would therefore be appropriate in order to collect valid data.

4.4 Tasks

In this section the tasks assigned to the participants are described in detail. As there are several tasks involved in this study, with many elements to be tested, the tasks have been divided into several focus group case studies. This has allowed for comparisons, between both focus groups and the webtools they used, to be made later on.

4.4.1 Focus Group A

Focus Group A used the paid for Kerboodle package to complete a series of revision lessons. Following the lessons, they were asked to evaluate their experiences with Kerboodle using the questionnaire which can be viewed in Appendix 2. This was the same evaluation as completed by Focus Group C (described later). To contrast this, the group were introduced to the wiki to write their own revision page (www.aqascience.wikispaces.com). They then completed a very similar style questionnaire for this webtool. This was done so as to compare their enjoyment, engagement and their perceptions of their learning when using both tools.

The teacher had then built and developed a free website for Year 9 using Yola (www.yola.com), which was similar in design to the one developed for Year 10. This group completed some activities which the teacher had uploaded to the Year 9 website (www.year9.yolasite.com) and the students discussed the answers to one of the activities using some Etherpads and corkboards (www.corkboard.me). The teacher conducted an interview with the whole class at the end of the lesson to elicit what they had thought about the webtools and what could be improved if they were to do a similar lesson again. The students were able to give good, orderly, constructive feedback to the teacher.

The teacher was then approached by two Information and Communications Technology Post-Graduate Certificate in Education (PGCE) students from an East Midlands university who were on placement at the school, to take part in some research into engagement and literacy using webtools. Another website was developed for the observed lesson (www.9sherwin.yolasite.com), the lesson plan for which can be viewed in Appendix 16.

The lesson involved groups of students using etherpads to discuss methods of metal extraction, making a flow chart and then using a corkboard to place a Post-it note on the Interactive Whiteboard about what they had learnt in the lesson. The lesson was observed by the PGCE students and their University mentor. At the end of the lesson the students completed a lesson evaluation which was designed by a lecturer at the university, the outline for which can be viewed in Appendix 2. 26 students also completed a voluntary ICT questionnaire towards the end of their course detailing their experiences and background with ICT. This was done quietly and individually.

4.4.2 Focus Group B

Students in Focus Group B were Year 10 X-band (half of the cohort) students who were revising for their GCSE Science examinations. Prior to the revision lessons, the teacher built a website which had various activities for the students to complete, using free online webtools. These included online crossword puzzles, embedded matching games and links to other websites. The site was designed to be easy to use by students, bright, colourful and engaging. The participants in Focus Group B then went to the computer room and completed some revision lessons using the website (www.year10science.yolasite.com). At the end of the lesson the students were given a short questionnaire which they completed individually to evaluate the lesson and the webtools they had used. The students were quiet but not silent when they were completing their evaluations so there may have been some discussions between students sitting next to each other, which may have affected the results. Twelve students in this focus group finished their questionnaire and volunteered to also complete an ICT questionnaire at the end of the lesson. Both questionnaires can be viewed in Appendix 2.

4.4.3 Focus Group C

Like Focus Group A, all the students in 10Y who were studying for their GCSE Core Science had been issued with a user name and password for the commercial package provided by Kerboodle, which the science department had subscribed to for the 2011-2012 academic year. The three classes used the software provided online by Kerboodle in a series of revision lessons and then a sample of students were randomly selected as described previously to form Focus Group C. These students evaluated their experiences with Kerboodle using the questionnaire which can be viewed in Appendix 2.

In a separate series of lessons, prior to their June examinations, the students in these classes also developed the www.aqascience.wikispaces.com wiki. The wiki was first set up by the teacher and the home page and infrastructure was developed. The students were then given the opportunity in lessons to create pages of revision notes and resources to add to the wiki. Some students then worked in groups to answer some of the longer answer questions from past exam papers, by recording their answers as Pixton (www.pixton.com) comic strips, using a Dictaphone and Audacity to give verbal answers, taking photographs and filming short videos. Some chose to hand-draw storyboards and photograph them using a webcam. All of the contributions were uploaded to the wiki and the students had the opportunity to listen to, read or watch all the answers. At the end of the project all the students were encouraged to give open verbal feedback in an evaluation session following the completion of the multimedia activity. The researcher encouraged the students to discuss the webtools amongst themselves and facilitated the discussion, noting observations and students' opinions. Although these focus group interviews seemed unstructured, the preparation involved in planning the lessons and the nature of the lessons themselves gave the teacher good opportunities in which to speak to students about the webtools and observe any strengths and limitations easily. It is worthy of note here that these classes were vocal about the technologies and keen to express their opinions about the webtools used at the end of the series of lessons.

4.4.4 Focus Group D

Focus Group D was set up to further investigate the webtools trialled with Focus Group 13C from the pilot study. Prior to their examinations, the students were allocated two hours in the computer room in which they were taught how to build a revision website using the online website builder software provided by Yola (www.yola.com). The students were encouraged to use the website and continue to develop it over their AS Chemistry studies. The websites were then catalogued on a website set up by the teacher for this purpose (www.chemhub.yolasite.com) where they could be used by AS Chemistry students for revision purposes. The teacher also developed three AS science websites to act as a temporary Virtual Learning Environment (the first of which was www.emschemistry.yolasite.com), and linked any good student-produced websites to the correct topics. Occasionally, students were set homework tasks based on accessing the student-produced websites, and they were also included in the Chemistry bridging project for Focus Group E.

This group also investigated the impact of using a wiki for writing up experiments (www.labbookonline.wikispaces.com). After setting up the wiki, the teacher taught the students how to use it and then set them the task of writing up an experiment online. The rationale was that the wiki would become a valuable resource in the future, where students and others could view and revise the practical activities they had done in class, practise writing up experiments and investigate other linked experiments. Two hours of class time were given to the students at first and then the wiki was updated throughout the year as the students completed experiments.

On one occasion, the group were also asked to try to use some etherpads (openetherpad.org) in preparation for introducing them to Focus Group A, and comment on any issues that they could think might arise when using them with a Year 9 group. They were given a question to answer on the etherpad and all students accessed the pad and discussed the answer. All students in Focus Group A completed an extended ICT questionnaire and one about their perceptions of the webtools, at the end of the course. The students were allocated time in class to complete the questionnaires, which they did individually and in silence. The two questionnaires can be viewed in Appendix 2. Some students who were absent when the questionnaires were given out at the end of Year 12 completed them at the start of Year 13 instead, under the same conditions, so that the whole group was surveyed. It is recognised that these students may have recalled their experiences less well due to the break but this was unfortunately unavoidable.

The eight students who continued into the A2 Chemistry group were asked to expand on some of their answers in a small group interview, in which five of these students contributed answers. The transcript of the short interview can be found in Appendix 11. The questions were decided upon beforehand by the researcher in response to both the research questions and unusual responses in the questionnaires. Detailed notes were taken by the researcher during the interview and the transcript was then shown to the students, who all agreed that it was an accurate transcription of the interview.

4.4.5 Focus Group E

At the end of their Year 11 studies, prior to the students going on examination leave, all Year 11 students in the school were asked if they intended to study one of the three sciences at AS level. Any student that stated that they might do this was given written details of an online set of three Bridging the Gap projects. These projects comprised a series of worksheets, videos to watch online and activities such as creating websites, which had been written by either the researcher or colleagues in the science department. The subject material was chosen to help the students revise essential parts of the GCSE course which were required in their AS studies, areas where students required to complete significant background reading or topics that students would cover at the start of their new courses. The project was uploaded onto the Science Department website (www.emsscience.yolasite.com) and students were offered email support by the researcher throughout the holiday as and when necessary. Any students who completed one or more of the projects handed in their work, which was promptly marked and returned by the teacher.

The nineteen students in the AS Chemistry group were used as a focus group and all completed a short evaluation which took the form of a questionnaire. This took the students between two and ten minutes of class time to complete. The students completed their evaluations individually and in silence so as not to influence others. The questionnaire used can be viewed in Appendix 2.

4.5 Data analysis

This section details how the data were to be analysed and how samples if possible were taken.

4.5.1 Quantitative data

As the research questions relate to students' perceptions of their learning, the Likert scale statements' responses were then recorded on an Excel spreadsheet where the mean and standard deviation of the responses were easily calculated.

The Population Standard Deviation was calculated using the formula:

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2}$$

The Sample Standard Deviation was calculated using the formula:

$$s = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(x_i - \overline{x})^2}$$

where:

Σ = the sum of

N = the number of cases

μ = the population mean

$\overline{x}$ = the sample mean

x_i = an individual x value

These formulae have been adapted from the Stats Direct website and the justification for using this approach is described later. Laerd statistics (2013) state that the population standard deviation is used when the entire population has been sampled or when one has a sample of a larger population, but one is only interested in this sample and does not wish to generalise the findings to the population. The sample standard deviation is used if one has a sample but wants to make a statement about the population standard deviation from which the sample is drawn. Both samples and whole classes have been used in this study, although any generalisations made are done so with caution due to the small group sizes in this study. Therefore, both standard deviations have been included in the tables in Chapter 5 and have been used, as and when appropriate, in the text. Responses were ranked according to mean and displayed so that the most agreed with statement was placed first. Responses with a large standard deviation show that there was a large variation in response for that statement.

Cohen *et al.* (2011, p.627) comment that computer programs, such as SPSS, may be used to analyse data, for example the calculation of the mean and standard deviation of results. They state that: *"The mean is a useful statistic if the data are not skewed…or if there are no outliers that may be exerting a disproportionate effect."* It is therefore essential that the dispersal of responses is quantified. The standard deviation, as a measure of dispersal, may be calculated for samples of data where a low standard deviation indicates:

> *"…that the scores cluster together, whilst a high standard deviation indicates that the scores are widely dispersed. This is calculated automatically by software packages such as SPSS at the simple click of a button."* (p.627)

However, as the data were already recorded in an Excel spreadsheet, it was not necessary to use SPSS as Excel is able to calculate means and standard deviations easily. The researcher decided that further analysis of the data was unnecessary as due to the small sample sizes the reliability of any further statistical measures may be an issue.

4.5.2 Qualitative data

Cohen *et al.* (2011) warned that "*…there are frequently multiple interpretations to be made of qualitative data – that is their glory and their headache!"* (p.537) In order to minimise this potential issue, the qualitative responses were categorised first into positive response, negative responses, advice and neutral comments and then further subdivided into categories according to topics highlighted in the research questions, namely:

- Technology (features controlled by the teacher or features which were outside the teacher's control);
- Teaching;
- Learning; and
- Personal and social comments.

On occasion, further subdivision or omission of a category was necessary so as to allow for "*additional relevant factors that could emerge responsively from the data."* (Cohen *et al*., 2011, p.551). This can be seen in the qualitative response tables in Chapter 5.

Categorising was completed to aid constant comparative analysis (Thomas, 2009) and data was arranged in tables according to the themes or topics indicated above. However Cohen *et al*. (op. cit.), warned that using this method may lead to "*the wholeness, coherence and integrity of each individual respondent*" (p.551) being lost or the data becoming decontextualized. However, as these themes were based on the research questions, this was hoped to be minimal. In fact, Cohen *et al.* (op. cit.) found that organising qualitative data by research question is "*very useful*" (p.552) and "*enables patterns, relationships, comparisons and qualifications across data types to be explored conveniently and clearly*" (p.552). This method of organisation has been used in the discussion chapter.

4.5.3 Sampling

All research studies involve sampling of some kind. As this was largely a questionnaire-based study the population was clearly defined and in four out of the five focus groups, no sampling was required as the whole population has been surveyed and all responses were included in the analysis. This is due to the very small sizes of the classes involved in these focus groups. Gentry *et al.* (2005) advocate that using small, actual groups or classes of students and not harming the learning environment is more preferable than the converse.

With Focus Group C, the sampling technique used was an online random number generator which was applied to the alphabetical set lists to produce a list of nine students in each of a top, middle and bottom GSE Science set of the Y band cohort. This represented 40% of the Y band population or 20% of the Year 10 students taking GCSE Science. Cohen *et al.* (2011) advocate a minimum sample size of 30 as a 'rule of thumb' (p.144) and state "*the larger the sample, the greater is its chance of being representative*" so the sample of 27 students was thought by the researcher to be appropriate in this case, especially as only means and standard deviations were to be calculated, rather than more in-depth statistical analysis.

Cohen *et al.* (2011 p.153) refer to this method as 'simple random sampling' as a method of probability sampling and advocates this as a method as it has less risk of bias than a non-probability sample which is unrepresentative of the whole population. It was thought that this method of sampling was a simple, quick technique which could be carried out in class easily, and also took into account the fact that the different sets had their lessons on different days so there may have been technical issues on one day that were not present on another. It would have also been possible to ask all students to complete the questionnaire then apply the sampling method to the completed questionnaires. The first method described was deemed more appropriate in order to reduce photocopying costs and administration time.

Also of particular relevance to this study, they (op. cit.) comment that:

> "*Sample size limitations in most courses may result in the researcher performing strange permutations to generate a decent sample size. If one has a small class size, one should use that to facilitate learning*

> *rather than being concerned with aggregation to a sufficient size of similar student situations and possibly harming the learning environment.*" (p.135)

It is worthy of note that the teacher did not seek to control class size in this study in any way. Some case study classes have a very small sample size, for this reason, and although the implications of this have been discussed elsewhere in this thesis, it is noted here that although an unfortunate consequence of conducting research in schools, the experimenter agreed that the learning environment must be the primary concern of the teacher when conducting practitioner research (Fox *et al*., 2007) to inform best practice.

All the focus groups involved in the study were therefore smaller in participant numbers than would have been ideal and were opportunistic samples. This is an unfortunate product of conducting research in a school environment, and if the researcher had had more free time within the school day to conduct interviews, or there were more people involved in conducting the research then the reliability of the study would have undoubtedly increased.

4.6 Ethical considerations

This section outlines how it was ensured that the research described within this thesis followed all the necessary school and research ethical guidelines. Research was first conducted into the ethics of the use of students in pedagogical research. Numerous studies exist, although they mostly concern university students rather than those of secondary school age. Four areas of concern are identified by Storey *et al*. (2001) in relation to the ethical concerns of using students to evaluate web based learning tools. These are informed consent, minimisation of harm in relation to merit, competence and confidentiality.

Cohen *et al.* (2011, p.78) divide informed consent into "*competence, voluntarism, full information and comprehension*" which implies that participants should be able to make appropriate decisions, and be able to freely choose to opt out of the research, which they have been reasonably informed about and understand the nature of.

Ethical clearance was first sought from Loughborough Design School and the correct procedures were adhered to, to obtain ethical clearance. The relevant forms were completed and submitted to the MPhil supervisor who approved the project. It is understood that the method of applying for ethical clearance has since changed but as this study began before this change, approval from the Ethical Advisory Committee was not required.

As discussed it is a requirement of academic research that participants are informed about the nature of the study and have a free choice over whether they agree to participate or not. Cohen *et al.* (2011) explain this point:

> *"The principal of informed consent arises from the subject's right to freedom and self-determination. Being free is a condition of living in a democracy, and when restrictions and limitations are placed on that freedom they must be justified and consented to, as in research."* (p.77)

As most of the students concerned here were under sixteen years old, permission was also required from parents or carers. Prior to undertaking the study, all participants were informed fully of what the research would involve and what they would be required to do should they choose to take part. In addition, the Principal of the school was consulted on the best method of informing parents and carers of the nature of the study. His consent to carry out the research was given and it was agreed that a letter would be able to be generated and posted out to families.

A letter was sent out to every student in the focus groups informing parents and carers of the nature of the research and what they should do if they did not wish their child to participate in the study. Examples of all the letters given out are located in Appendices 12-14. It is unfortunate that many parents and carers often fail to return reply slips to the school, and fearing that this may limit the sample size significantly, the informed consent letter was worded such that participation would be assumed unless the parent or carer, or indeed the student wished to opt out, in which case they should contact the school directly and state this, and they would not need to give a reason. In addition to this, all participants were given every opportunity of informing the class teacher if they no longer wished to participate, and were informed that they would not have to give a reason for doing so.

No students, parents or carers informed the school or teacher that they did not wish to take part in the study. Should any student have opted out, they would have undertaken the same tasks but would not have had to complete any questionnaires. The questionnaires were designed so as to not disrupt learning in the lesson, but instead promote reflection. It was judged that no longer than an hour would be spent by any one student in completing the questionnaires over the course of a year and that time was not significant enough to impact negatively on learning, meaning that students' learning was not disrupted by completing questionnaires in class time.

Some studies into the ethics of using students in research have recommended that it is only appropriate if the research is integrated into a learning sequence. For example, Gentry *et al.* (2005) state that:

> "*If the research is self-serving and exploitative in nature, then we advise against its use in a classroom setting. However, systematic integration of the topic of the research with the course content may result in a satisfactory learning experience.*" (p.134)

It was felt that the webtools were integrated well into the course content in this study, students were not put under significant stress by using the webtools and an alternative was made available if the student had not been able to access the webtools for some reason. As classes were held at least on a weekly basis, all participants had every opportunity to discuss any concerns with the researcher, who could also see if any participants were experiencing stress due to the study. This was not observed, and quite to the contrary; students regularly informed the teacher that they had enjoyed participating.

Prior to using any webtools with students, they were evaluated by the experimenter in a non-classroom setting. Although the teacher did not have a computer science background, the webtools investigated were geared at instructors who had less expertise than the teacher so it was not considered that competence was a significant risk factor in this research. The one exception to this was the case study involving the use of etherpads, which were not familiar to the teacher prior to the use of them in the classroom. The evaluations for this case study may be biased because of this, and indeed, should the case study be repeated, the experimenter encourages thorough evaluation of the etherpad tool before allowing students to use them!

All of the paper questionnaires from this study were collected and stored securely, firstly in a locked cabinet in the Science Department, and then in a folder in the experimenter's house. It was thought that this was more appropriate than storing them at school indefinitely where other members of staff may have had access to them, as they could be accidentally lost amongst other paperwork! It also allowed the teacher to be able to easily extract any questionnaires from students who did not want to participate any longer, although this was not necessary. Copies of the responses from the questionnaires were stored in an Excel file on the teacher's home computer, and a back-up was stored on a memory stick. Students had the option of adding names to their questionnaires or not and it was always made clear that it was not necessary to provide their name. On the Excel spreadsheet, questionnaires were referenced using a unique identification number rather than name, to increase confidentiality but still allow tracking of responses. Initials were added to the Key Stage 5 responses to assist in tracking of interview responses. At the end of the project all individual responses were destroyed.

4.7 Pilot study

Prior to completing the main study it was essential for the experimenter to be familiar with the webtools. Thomas (2009) advocates the use of a pilot study to prepare for a larger one, and states "*It is done to refine or modify research methods or to test out research techniques*" (p.132). Two classes were chosen to try out the webtools which were to be used with the focus groups previously described. The research detailed in this pilot study was conducted in 2011 in the previous academic year to the research undertaken with Focus Groups A-E. The following section summarises the pilot data collection stage and details of how these data were analysed.

4.7.1 Aims

The main aims of the pilot study were:

a) To allow the researcher to trial webtools with classes; to find out what tools would be available for the duration of the project, and if any would be blocked by the school or EMBC (now Openhive).
b) To allow the researcher to gauge whether students would be willing participants for the main study.

c) To allow the researcher to increase her knowledge base with respect to webtools and generating her own online content.
d) To trial methods of data collection, to enable identification of any major issues.

4.7.2 Classes

Pilot Class 9M

9M was a mixed ability class of twenty seven students, and at the time of the pilot study, they were aged between 13 and 14 years. The students in this class had already completed their Key Stage 3 studies in science prior to the Spring term and had then moved on to their GCSE in Core Science. At the end of the pilot study, they had just completed the Chemistry part of their Year 10 GCSE (subject knowledge) work.

Pilot class 13C

13C was a mixed ability group of 14 A2 Chemistry students, aged between 17 and 19 years. All the students in this group were studying for their OCR GCE A2 in Chemistry in 2011 having successfully passed AS Chemistry the previous academic year.

4.7.3 Tasks

Pilot Class 9M – www.year9.yolasite.com

At the end of their Key Stage 3 work, 9M were due to be given two past-National Curriculum Assessment papers to help the science department to assess their levels and provide further evidence for setting the students in Year 10. It was decided to explore how webtools may help the students revise for these tests. An idea was formulated that interactive tasks and quizzes may increase the students' engagement with revision, but the teacher also wanted the students to be able to access and complete past papers if they wanted to do this. It was thought that it may be useful if the students could access these papers at home. What was needed was a way to create and host the quizzes, link to other online activities and helpful revision websites and a place to store past papers as downloadable files.

At the time, the school did not have a VLE which would have been an ideal solution. With this in mind the experimenter designed and made the website “www.year9.yolasite.com” using free online software from www.yola.com. The teacher had been introduced to this site at a course she attended at the National Science Learning Centre in York, entitled Online Science, which explored the use of webtools and technologies in teaching and learning.

As can be seen in the screenshots in Appendix 5, the website allowed for the embedding of a crossword puzzle that the teacher had generated using some free online software from Proprofs (www.proprofs.com), hyperlinks to other useful sites and uploading of the documents easily. During the lesson, the students completed the online tasks on the website. The teaching assistant commented that the students were quiet and engaged well with the activities for the whole hour long lesson! Some students downloaded and completed the past papers during the lesson, whilst others said they would rather do this at home. Some even handed in paper copies of the practise questions to be checked and others emailed the electronic version, which were promptly marked by the researcher and emailed back to the students before their exams.

Pilot class 9M - Glogster

The Online Science course also introduced the teacher to some interactive poster making software called Glogster. Using this webtool, students are able to generate their own interactive poster, using images, text, sound and animations. This brought a new dimension to the traditional PowerPoint presentation activity that had been previously undertaken with 9M, and other groups. Another lesson was planned where the class were able to use Glogster to create interactive presentations called ‘Glogs’.

Pilot class 9M - Quizzes

At the end of this group’s GCSE Year 10 Chemistry module, it was decided to again use ICT to help the students revise for an end of module test. It was thought that this was a good opportunity to compare two online quiz tools that the teacher had used before. A ten question test was generated using Polldaddy and a twenty question test was made using Proprofs quizzes. The quizzes and the group results for each quiz are in the appendix. The students had twenty minutes to revise for the tests using sites such as BBC Bitesize Science and were then permitted to keep these tabs open when completing the tests, so that it became an open-book test. This approach was decided upon because the teacher did not yet want to test the students' knowledge, but instead encourage the students to take a more active approach to revision. The students had to read the material on the revision websites in order to answer the questions correctly.

Pilot class 13C - websites

From experience, the teachers at the school had found that the teaching time required for the second unit in the A2 Chemistry course was rather short compared to the first, and as such students have a number of weeks to revise thoroughly after completing the subject content and practical examinations. Whilst this is beneficial to the students, they also often find that simply completing and marking past papers during this revision period becomes rather dull. Therefore, the teachers always attempt to make their revision varied, interesting and, if at all possible, fun! Students were also encouraged to revise actively, rather than just passively allowing their revision to wash over them.

With this in mind, and also the thought that one must know ones subject inside out if one is to teach it to others, the teacher assigned one topic from Unit 1 and one from Unit 2 to each student and firstly asked them to make a website about their Unit 1 topic. Having researched different free website creation software, the students were invited to use Yola (www.yola.com) to design and create their website as this webtool had been used before by the class teacher who thought that she could support the students effectively with Yola, could answer most questions and could solve most problems as they arose. The students were given two hours of class time to begin building their websites. In the first hour the students spent some time familiarising themselves with how to build their website and the material they would be putting on them. To help them, the teacher composed a simple guide to using Yola, which can be seen in Appendix 6.

4.7.4 Results

Pilot class 9M - www.year9.yolasite.com

At the end of their lesson the students were asked to complete an online survey, which the teacher had already embedded into the website during the early part of the lesson, using another free online suite of webtools called Polldaddy (www.polldaddy.com), the results of which can be seen in Table 4.8.4:

Question n = 27		Yes	No	Don't know / Not sure
Did you like the website layout?		22	3	2
Was the site easy to find?		23	2	2
Do you prefer this to normal class work?		21	2	4
Did you learn anything new today?		22	1	4
Do you like using the computers to do revision activities?		26	1	0
I will now go and revise the topics that I found more challenging		20	1	6
I would like to do this sort of lesson again		26	1	0
	Bitesize activities	Cross-words	Multiple Choice	Fill In Gaps
Which activity did you like the most?	16	7	4	0
		OK	Easy	Hard
How did you find the questions?		23	3	1
		1-3	4-8	8+
I managed to try approximately ___ activities		6	13	8

Table 4.8.4: Results of 9M GCSE revision lesson survey (n = 27)

It was felt that the use of ICT in this lesson was highly effective. In a short, informal class discussion with the students at the end of the lesson, the students said that they felt that they were revising actively, learning and refreshing their memories effectively and perhaps most importantly, that they were enjoying their revision. It was intriguing to find out what the students had thought about the lesson. The teacher was pleased to find that all 27 students had completed the survey. 22 students said that they liked the website layout and 23 said that the site was easy to find. It was actually found that in subsequent lessons, students automatically went to the website when they logged on, which the teacher found to be very encouraging! It was perhaps not surprising that 21 students in this class preferred these kind of activities to "normal" class work and after speaking to individual students the researcher found that those who did not prefer the ICT activities were the very high achieving students, who then commented that they enjoyed completing and marking past papers more, and did not find that doing that was tedious.

Only one student in the class thought that they had not learned anything new during the lesson, and that was because they had "*revised well at home*" and 22 students felt that they had learned new things in the lesson. This highlights the importance of revision in filling in gaps due to absence or not understanding the concept the first time round. 26 students commented that they liked to use computers for revision activities and would like to do this sort of lesson again, and most students thought that the questions were pitched at the right level. The teacher was pleased that 20 of the 27 students said that the lesson had spurred them on to do more private revision of the topic they understood less well, as this now showed that the lesson promoted independent study.

Following the past-National Curriculum Assessment papers, 9M began their AQA GCSE Science work in Chemistry. Mid-way through their module it became desirable to review their progress so the www.year9.yolasite.com website was modified by the teacher to include a task in which the students had to use the BBC Bitesize commercial website to make some revision cards. The students again commented that they enjoyed using their ICT skills to use Microsoft PowerPoint to make bright, colourful, animated flashcards. They then swapped computers with the person next to them and read through the flashcards their partner had made. They were only given one minute per card, so the class became much more focused at this point. As the teacher moved around the room, it was found that the students were all engaged, with most 'competing' to learn the most they could from the flashcards, before swapping back to their own computer and completing the Test Bite for that topic. It was found that such a simple, fun activity yielded good results when many then scored full marks on their Test Bites and students stated that they had been very encouraged by their scores.

Pilot class 9M - Glogster

During their Glogster lesson the students commented that the site was easy to use. The teacher noted that uploading their pictures was fairly easy for them to do, and only a few required help. Again, engagement levels were high. Students were interested in what the person next to them was putting on their 'Glog' and this spurred them on to make their own more interesting, colourful and informative.

The students clearly liked that they could make their Glogs personal to themselves by using any colour, font and graphics they liked from the wide selection and they could easily change the positions of all their objects by dragging them wherever they wanted. The teacher personally thought that the increased level of engagement, with what was otherwise a data retrieval and presentation task, was well worth the few minutes it took to teach the students how to use the software. Two examples of the Glogs students created during this hour lesson can be found in Appendix 9. Realistically, around 30 minutes were spent actually generating the finished product, and it was felt that the levels of information on each Glog were quite high given the small amount of time the students were given to complete the task.

Pilot class 9M - Quizzes

The students appeared to enjoy using the quiz tools. It was found that the students wanted to try to get full marks because they knew it was *"achievable, as all the answers were right there in front of me"* (as informally commented by one student). In previous revision sessions with other Year 9 classes it was often found that students would ask for the answers to questions they didn't know, but in doing the online tests it became obvious that students were very happy to find the information out for themselves, and if they asked the teacher for help, it was for advice on which section of the revision site the answer might be on, rather than the answer itself. This promoted independent learning within the group and a more mature approach to studying, where the student could rely less upon the teacher and more upon themselves to further their knowledge.

The individual results can be seen in the Appendix 7. The questions were checked thoroughly prior to the lesson. For the first Polldaddy quiz, only 23 students submitted their scores successfully as there seemed to be an issue with a few students whereby they had pressed the submit button, but then the website or quiz timed out and their score was lost. This was one of very few problems encountered during the lesson. One student decided to complete the first quiz again to improve his score, which he did, by 11%. Many more students decided to retake the second quiz if they had time, in order to improve their score. This could have been because the Proprofs Quiz website generates a printable certificate when the student completes a quiz, and the students stated that they liked this reward. Some were so proud of their achievement that they printed their certificates off to show their parents or guardians.

Unfortunately, unlike Polldaddy which caps the number of questions per quiz at ten, but allows the teacher to view all the individual scores, Proprofs allows the teacher to set more questions, but they may only view ten students' individual scores. Proprofs does give more information though, such as the amount of time the student spent on the quiz.

The results are shown below:

Test score (%)	Number of students n = 23
0 - 50	**0**
51 - 60	**3**
61 - 70	**6**
71 - 80	**5**
81 - 90	**7**
91 - 100	**2**

Table 4.8.1: Results for Polldaddy quiz (n = 23)

Test score (%)	Number of attempts n = 40
0 - 30	**0**
31 - 40	**2**
41 - 50	**2**
51 - 60	**4**
61 - 70	**3**
71 - 80	**3**
81 - 90	**11**
91 - 100	**15**

Table 4.8.2: Results for Proprofs quiz (n = 40)

As can be seen, over half of the students' scores were over 80% with the Proprofs quiz but 4 students scored under 50%. 9 of the 23 students scored over 80% on the Polldaddy quiz but all students scored over 50%. At the end of the lesson the students were asked for some verbal feedback about the two quizzes in terms of ease of use, layout and which, if any, they preferred. The students generally agreed that they liked the Proprofs quiz better because they could see the answer to each question as they went along, and so they became more confident as they went through, if they were getting the answers correct, and if they were getting them wrong, it made them concentrate more on the next question. They thought that the Polldaddy quiz had a simple and effective layout and was very clear but they liked the certificate they were awarded at the end of the Proprofs quiz more.

From a teacher's perspective, both quizzes displayed class results very effectively, so these could be discussed in lesson. However, the Polldaddy quiz shows the percentage of students selecting each option, whereas the Proprofs quiz only categorises the responses into correct or incorrect answers and therefore does not highlight misconceptions as effectively as the Polldaddy quiz does. It is also rather frustrating that only ten individual results may be displayed for the Proprofs quiz and only ten questions may be set per quiz when using Polldaddy.

Pilot class 13C - websites

Students all made a website successfully and the researcher was able to answer any questions which arose. At the same time as the students were creating their websites, the teacher created the Chemhub website (www.chemhub.yolasite.com) to inform other people about their websites, and also to link together all the websites they had generated, so they could use one another's websites for inspiration, and for their own revision purposes. The Chemhub was a dynamic website and remained an active work in progress throughout the study and evolved as more students contributed to the project. All the students' sites are found on the 'Links' page, and these were developed over the rest of the 2012-2013 academic year, as more students contributed, with more information about their Unit 2 topic added as the students began their revision for their examination.

4.7.5 Conclusion

The pilot study achieved its aims as it allowed the researcher to trial a variety of webtools with classes. All the webtools trialled were not blocked (at the time) by EMBC, but the following year Glogster was blocked so the researcher was unable to use this tool in the main study. It appeared that it was likely that students would be willing participants for the main study as those in the pilot focus groups appeared keen to share their opinions. The researcher was also able to increase her knowledge base with respect to Yola, Polldaddy, Proprofs and Glogster and at the end of the pilot study felt more confident with generating her own online content and being able to assist students with doing the same.

In terms of data collection methods, although online surveys were quick and easy to set up, the researcher felt that the two quiz tools trialled were not robust enough for collecting data in the main study because of the limitations of either the number of questions able to be set, or number of responses able to be analysed. Following the 9M lesson the researcher concluded that ideally, a quiz tool should be able to allow teachers to set at least twenty questions per quiz; display class results for each answer option in order to highlight misconceptions; show all the individual results as percentage scores and amount of time spent on the quiz and most importantly not charge a subscription fee for any of the above! It appeared that neither tool could do all of these things well so the researcher concluded that paper surveys may be more appropriate in the main study.

CHAPTER FIVE

PRESENTATION OF THE FINDINGS

5.1 Data

In this chapter the qualitative and quantitative analyses of the responses from the questionnaires are presented in tables and charts (figures). The transcript of the small group interview can be found in Appendix 11. In this results section, the means and standard deviations of numerical data were calculated as described in the Methods section and similarly, the qualitative data were categorised into responses concerning:

- Technology – features controlled by the Teacher
- Technology – features not controlled by the Teacher
- Teaching and Literacy comments
- Learning and Engagement comments
- Personal and Social comments

This was done after the responses were collected and analysed, but was largely in line with the categories proposed in Chapter 4. The researcher chose these categories as they divided the comments well and allowed the researcher to quickly see what types of comments the students were making, as well as addressing the research questions. These comments were then further divided into positive and negative/advice columns to aid in the triangulation between qualitative and quantitative responses.

In a selection of the tables in this section (Tables 5.1.1a, 5.1.1.d and 5.1.1e) numbers of responses that the researcher thought were significant were highlighted in the tables. A number was deemed significant if 4 or more students chose that option or a third or more of the group chose that option (3 or more students for the smaller KS4 group). The numbers were highlighted to aid visual comparison only and no statistical methods were used to calculate significance, largely due to the very small group sizes. For this reason, caution must be exercised when making inferences based on these results.

The results are presented in the following order:

5.1.1 Participant Demographics

- Student skill and experience ratings
  - Table 5.1.1a: Students' perceptions of their current ICT skills
  - Table 5.1.1b: Students' ratings of their own skills with various ICT tools
  - Table 5.1.1c: Students' ratings of their overall experience with various ICT tools
- Students' current use and contribution to webtools
  - Table 5.1.1d: Students' current use of or contributions to Webtools
- What technologies do students own and use?
  - Figure 5.1.1b: What hardware have students used before?
  - Figure 5.1.1c: What hardware do students own?
- Students' interest in Webtools
  - Table 5.1.1e: Webtools students want to learn how to use

5.1.2 Year 9 Wikispaces Evaluation

- Table 5.1.2a: Likert scale responses for Year 9 Wikispaces Evaluation Survey
- Table 5.1.2b: Year 9 Wikispaces Evaluation Survey Responses – Means and Standard Deviations
- Table 5.1.2c: Analysis of written responses for Year 9 Wikispaces Evaluation

5.1.3 Year 9 Kerboodle Evaluation

- Table 5.1.3a: Likert scale responses for Year 9 Kerboodle Evaluation Survey
- Table 5.1.3b: Year 9 Kerboodle Evaluation Survey Responses – Means and Standard Deviations
- Table 5.1.3c: Analysis of written responses for Year 9 Kerboodle Evaluation

5.1.4 Year 10 Kerboodle Evaluation

- Table 5.1.4a: Likert scale responses for Year 10 Kerboodle Evaluation Survey
- Table 5.1.4b: Year 10 Kerboodle Evaluation Survey Responses – Means and Standard Deviations
- Table 5.1.4c: Analysis of written responses for Year 10 Kerboodle Evaluation

5.1.5 Year 10 Website Evaluation

- Table 5.1.5a: Likert scale responses for Year 10 Website Evaluation Survey
- Table 5.1.5b: Year 10 Website Evaluation Survey Responses – Means and Standard Deviations
- Table 5.1.5c: Analysis of written responses for Year 10 Website Evaluation

5.1.6 KS5 Webtools Evaluation

- 5.1.6a Blogs
  - Table 5.1.6a KS5 Students' Perceptions of Blogs - Means and Standard Deviations
- 5.1.6b Wikis
  - Table 5.1.6b KS5 Students' Perceptions of Wikis - Means and Standard Deviations
- 5.1.6c Course Websites
  - Table 5.1.6c KS5 Students' Perceptions of Course Websites - Means and Standard Deviations
- 5.1.6d Making Yola Websites
  - Table 5.1.6d KS5 Students' Perceptions of Makiing Websites - Means and Standard Deviations
- 5.1.6e Webtools
  - Table 5.1.6e KS5 Students' Perceptions of Webtools - Means and Standard Deviations
  - Table 5.1.6f: Analysis of written responses for KS5 Webtools Survey

5.1.7 Year 12 Bridging Project Evaluation

- Table 5.1.7a: Likert scale responses for Bridging Project Evaluation Survey
- 5.1.7b: KS5 Students' Bridging Project Survey Responses - Means and Standard Deviations
- 5.1.7c: Analysis of written responses for Year 12 Bridging Project Survey

5.1.8 Year 9 TDA Literacy Project

- Table 5.1.8a: Year 9 Pupil Voice Survey categorical responses
- Figure 5.1.8a: Student enjoyment of the lesson – features
- Figure 5.1.8b: Student enjoyment of the lesson – reasons
- Figure 5.1.8c: Literacy skills
- Figure 5.1.8d: Key word understanding
- Table 5.1.8b: Year 9 Pupil Voice Survey written responses

Figure 5.1.1a: Structure of the Presentation of the Results Chapter

5.1.1 Participant Demographics from ICT Survey

This section details background information about three of the focus groups, for comparative purposes. The researcher wanted to find out how students at this school viewed their current ICT skills, ICT experience and contribution to webtools during the first term of the study as it was thought that an overall picture of the cohort may help to suggest reasons for any later findings. Students completed the ICT survey, found in Appendix 2. As this survey took place early on in the study, before all the focus groups were formally identified, students from each of the transition points (Focus Groups A, B and D) which had already been identified, were asked, in a science lesson, to complete this ICT survey. 25 KS3 students, 12 KS4 students and 16 KS5 students elected to complete the survey, although some of the KS4 students did not complete all of the survey and therefore the responses may not total 12 in some tables and charts. The numbers of students who completed each section of the survey are detailed before and after each table or figure. As the group sizes were small, the numbers of responses rather than the percentage of each response were given in the tables and figures in this section. The (Queensland Government's) Office of Economic and Statistical Research (2011) agree that:

> "*In general, it is irritating, if not unacceptable, for a report to be written quoting only percentages. A person reading a report on findings from survey data must be easily able to determine the base (i.e., the number of cases) on which percentages have been calculated. It can be quite misleading to present percentages and especially changes in percentages when the base for the percentage is very small.*" (p.1)

Further representations of these data which were used by the researcher when analysing the responses can be viewed in Appendix 10. The results of this ICT survey are broken down into these major sections for clarity:

- Student skill and experience ratings;
- Students' current use of and contribution to Webtools
- What technologies do students own and use?
- Students' interest in Webtools

Student skill and experience ratings

Table 5.1.5a summarises the ICT skills that students in KS3, KS4 and KS5 already possess, according to their own perceptions. The skills related to their use of, for example, e-mail, web browsers, word processing, spreadsheets, graphics packages and presentation software. The students did not have to prove that they could complete these tasks so these data may be subject to some bias related to the students' confidence or understanding and interpretation of the questions in the left-hand column. All 25 Year 9 students and all 16 KS5 students completed this section of the survey but only 8 of the 12 Year 10 students elected to complete this section. Due to the variations in group size and the small group sizes caution must be exercised when analysing interpreting these results.

In table 5.1.5a, the modal response for each Key Stage was highlighted dark grey and any further responses that were considered by the researcher to potentially be significant (4 or more students or 1/3 of the group choosing a particular answer) were highlighted light grey for clarity.

What can students do already?		Year 9 KS3	Year 10x KS4	Year 12/13 KS5
Can you send, read, forward and delete e-mail messages?	Yes	25	8	16
	No	0	0	0
	Unsure	0	0	0
Use an address book to store e-mail addresses?	Yes	20	6	15
	No	1	1	1
	Unsure	4	1	0
Filter e-mail messages?	Yes	18	5	15
	No	1	0	0
	Unsure	6	3	1
Use/manage bookmarks (Firefox) or favourites (Internet Explorer)?	Yes	19	8	15
	No	2	0	0
	Unsure	4	0	1
Locate information/resources using search engines e.g. Google?	Yes	24	8	16
	No	1	0	0
	Unsure	0	0	0
Save documents in folders?	Yes	24	8	16
	No	0	0	0
	Unsure	1	0	0
Cut and paste information between applications e.g. Word and Excel?	Yes	23	8	16
	No	0	0	0
	Unsure	2	0	0
Use the help functions within an application?	Yes	17	6	16
	No	1	1	0
	Unsure	6	1	0
Add links within and link to other pages when web authoring?	Yes	18	6	13
	No	3	0	1
	Unsure	4	2	2
Design page layout (e.g. using frames, tables or layers) when web authoring?	Yes	20	8	10
	No	2	0	3
	Unsure	3	0	3
Manage a website (6 or more pages)?	Yes	17	6	7
	No	2	2	2
	Unsure	6	0	7
Enter and change the appearance of text e.g. bold, italics in Word?	Yes	24	8	16
	No	0	0	0
	Unsure	0	0	0
Insert graphics into Word?	Yes	25	6	16
	No	0	1	0
	Unsure	0	1	0
Create your own styles & templates in Word?	Yes	23	6	12
	No	0	1	1
	Unsure	2	1	3
Enter data and formulae to perform calculations in Excel?	Yes	20	6	14
	No	2	1	1
	Unsure	3	1	1
Create and modify graphs in Excel?	Yes	19	7	14
	No	2	0	1
	Unsure	4	1	1
Record or write macros in Excel?	Yes	16	6	2
	No	4	1	5
	Unsure	5	1	9
Convert a colour image to black & white in Paint or Photoshop?	Yes	20	7	15
	No	2	0	1
	Unsure	3	1	0
Make the background of an image transparent in Photoshop?	Yes	14	7	11
	No	2	0	3
	Unsure	9	1	2
Create an animation in a graphics package?	Yes	15	4	8
	No	1	2	3
	Unsure	9	2	5

Table 5.1.1a: Students' perceptions of their current ICT skills (KS3 n = 25, KS4 n = 12 (8 completed this section), KS5 n = 16)

It appeared that most of the students in this who answered this section perceived that they have a good, broad skill level with ICT as the most common response to all questions (apart from "*Can you record or write macros in Excel*" for the KS5 group), was "Yes". This indicates that most students were confident that they could complete most of the activities listed in Table 5.1.1a. All the student groups appeared to be confident with managing e-mail, as all said that they could send, read, forward and delete e-mail messages. The students were also confident with using Word, especially functions like copying and pasting, (only two Year 9 students were unsure), inserting graphics (one Year 10 student said no, and one was unsure) and saving documents in folders (one Year 9 student was unsure) and all students thought that they could change the appearance of text.

Most of the "Unsure" responses came from Year 9 students, which the researcher thought to be expected due to the other students having completed more of their ICT studies at this point. These students may have chosen "Unsure" over "No" because they did not know what was being asked of them as they had not been introduced to the activity before. It is also possible that some students may have been able to do these tasks but may have not known the correct names for them.

The KS5 students were least confident in their ability to record macros, KS4 students were least confident with being able to create animations, and KS3 students were least confident with making images transparent in Photoshop though some students in all groups indicated that they could not do these activities. 19 students in total were not confident with their ability to manage a website. The researcher considered it important to note that almost half the KS5 group (7 students) responded that they were able to manage a website, though 2 students said that they could not and 7 students were unsure. These KS5 students, at the time of this survey were beginning to create their own websites in their Chemistry lessons, which may have accounted for this spread of results. These differences may have also related to the ICT teaching at the school and possible changes to the ICT curriculum.

The Year 9 class largely thought that they could manage a website of 6 pages (17 students) which the researcher found surprising. It is possible that they had recently completed this activity in their ICT lessons, but it is also possible that some did not understand the meaning of the word "manage" in this context, and thought that the question was asking them if they could successfully navigate through a website of 6 or more webpages. This is supported by the later question "*How would you rate your skills with a web authoring package*" for which the mean of 2.81 (see Table 5.1.1b) suggested that the Year 9 students have only a basic to intermediate skill level here.

These data helped the researcher to gain an understanding of how much preparation and explanation of the software the Focus Groups would require before completing the planned activities, as it can be assumed that if students indicated that they were already able to complete many ICT-based activities (such as those in Table 5.1.1a) they may not have needed as much time to familiarise themselves with the basics, than groups that had indicated that they had little or no ICT skills.

Table 5.1.1b shows the means and standard deviations of the students' ratings of their own skills with various ICT tools such as a web browser, word processor, spreadsheet and presentation software and other ICT packages. This table was colour coded to ease visual comparison. For the 'Mean' column:

- Dark green = 4.01 – 5.00, indicating an 'expert' rating;
- Light green = 3.01 – 4.00, indicating an 'advanced' rating;
- Yellow = 3.00, indicating an 'intermediate' rating;
- Orange = 2.00 – 2.99, indicating a 'basic' rating; and
- Red = 1.00 – 1.99, indicating a 'none' rating.

For the 'Sample SD' (Standard Deviation) column:

- Dark green = 0.00 – 0.54 indicating a narrower spread of results;
- Light green = 0.55 – 0.74;
- Yellow = 0.75 – 0.94;
- Orange = 0.95 – 1.14; and
- Red = 1.15 + indicating a wider spread of results.

These colours were assigned by the researcher to aid visual comparison within and between data tables, rather than representing a specific statistical interval. Means and standard deviations have been calculated by others for similar studies in the literature (for example, Rowe and Asbell-Clarke (2008), Workman (2008) and Yuen *et al.* (2011)) although some may have used the automatic calculation in programs such as SPSS (Buzzetto-More, 2008). The use of SPSS for analysis of the data in this study was thought by the researcher to be unnecessary as Excel can be used effectively to calculate means and standard deviations and as the group sizes were small further statistical analysis was not appropriate. For Table 5.1.1b below the following scale was used when the students rated their skills: 1 = None, 2 = Basic, 3 = Intermediate, 4 = Advanced, 5 = Expert.

How would you rate your skills with…	Year 9			Year 10x			Year 12/13		
	Mean	Population SD	Sample SD	Mean	Population SD	Sample SD	Mean	Population SD	Sample SD
e-mail?	3.31	0.80	0.82	3.11	1.10	1.17	3.69	0.85	0.87
a web browser?	3.92	0.93	0.95	3.40	1.11	1.17	4.13	0.70	0.72
a web authoring package?	2.81	0.80	0.81	1.90	1.14	1.20	2.56	0.86	0.89
windows and file management ?	3.23	0.79	0.81	3.10	1.14	1.20	3.63	0.86	0.89
a word processing package?	3.54	0.84	0.85	3.40	1.11	1.17	4.06	0.66	0.68
a spreadsheet package?	3.50	0.93	0.95	3.00	1.33	1.41	3.06	0.83	0.85
a presentation package?	3.77	0.93	0.95	3.43	1.18	1.27	4.00	0.87	0.89
a database package?	2.73	0.88	0.90	2.63	1.65	1.77	2.50	1.00	1.03
a programming language?	2.62	1.04	1.06	2.25	1.30	1.39	2.13	0.78	0.81
a statistical package?	2.77	0.99	1.01	2.50	1.58	1.69	1.75	0.83	0.86
a graphical package?	3.19	1.05	1.07	3.00	1.12	1.20	3.44	0.86	0.89
an animation package?	3.04	1.08	1.11	2.38	1.32	1.41	2.38	0.70	0.72
computer games?	3.62	1.11	1.13	3.13	1.27	1.36	3.50	1.27	1.32
Overall mean	3.23			2.86			3.14		

Table 5.1.1b: Students' ratings of their own skills with various ICT tools (KS3 n = 25, KS4 n = 12 (10 completed this section but 3 missed some questions), KS5 n = 16)

Overall, the KS3 group rated their skills highest and the KS4 group rated their skills the lowest of the three groups. The KS3 students indicated that they had the most skills with an Internet browser (mean = 3.92), presentation package (mean = 3.77) and computer games (mean = 3.62). KS4 students rated their skills most highly when using a word processor (mean = 3.40), Internet browser (mean = 3.40), and presentation package (mean = 3.43). KS5 students rated their skills with a presentation package (mean = 4.00), a word processor (mean = 4.06) and a web browser (mean = 4.13), the highest. They rated their ability to use a statistical package and web authoring the lowest. The KS5 group rated their ability to use a statistical package as more basic than Year 9 or Year 10 X-band students.

The large standard deviation for all of the KS4 results indicated that this group were divided on how they viewed themselves as ICT users for all the ICT tools listed in Table 5.1.1b. The researcher found this interesting as this group were set according to ability (in science) whereas the KS3 group were mixed ability but had much smaller standard deviations. The reason for the large spread with the KS4 group is likely to be due to the small number of students who responded to this part of the survey (10 KS4 students, compared to 25 KS3 students and 16 KS5 students). The largest standard deviation for the KS5 group was for the question "*How would you rate your skills with computer games?*" (mean = 3.50, SD = 1.32) and analysis of the raw data showed that there was no age or gender significance for this response, perhaps indicating that whereas computer gaming is a popular activity for students, some older students prefer other recreation activities.

Overall, despite students indicating in Table 5.1.1a that they were able to complete a variety of ICT-based activities, the mean responses in Table 5.1.1b showed that the students, on average, rated themselves at a basic or intermediate level, with only two exceptions in KS5 (using a web browser and word processor). Possible reasons for this include the fact that the students may be aware that the ICT tools can be used at a more advanced level than they use them at school, and some students may reserve the terms "advanced" or "Expert" for teachers of that skill. The results in this section were important to the rest of this study as they indicated the level at which the students in these Focus Groups thought that they were working and this suggests that there was room for improvement and development in all skill areas.

Table 5.1.1c illustrates students' ratings of their overall experience with various ICT tools as listed in the left hand column. This table is linked to the previous two tables which asked the students to rate their specific and overall skills with ICT tools and again, these results come from the analysis of the ICT survey which can be viewed in Appendix 2. This section asked the students to consider their experience with webtools such as blogs, wikis and social networking sites.

For the table below the following scale has been used: 1 = Strongly negative experience, 2 = Slightly negative experience, 3 = Neutral experience, 4 = Slightly positive experience, 5 = Strongly positive experience. Colour coding is as for Table 5.1.1b.

How would you rate your overall experience with…	Year 9			Year 10x			Year 12/13		
	Mean	Population SD	Sample SD	Mean	Population SD	Sample SD	Mean	Population SD	Sample SD
blogs?	2.58	1.05	1.08	2.78	1.40	1.48	3.00	1.32	1.37
collaborative writing tools?	2.46	0.84	0.86	2.67	1.33	1.41	2.75	1.03	1.06
your own websites?	2.50	0.87	0.89	2.67	1.25	1.32	3.44	1.00	1.03
podcasting?	2.31	0.94	0.96	2.89	1.37	1.45	2.56	0.61	0.63
social bookmarking /tagging?	2.46	0.84	0.86	3.11	1.45	1.54	3.44	1.17	1.21
social photo tools?	2.65	1.16	1.19	3.00	1.50	1.60	3.31	1.31	1.35
social networking sites?	3.69	0.66	0.68	5.00	0.00	0.00	4.06	1.30	1.34
social video tools?	3.54	1.00	1.02	5.00	0.00	0.00	4.50	0.71	0.73
virtual worlds?	2.65	0.88	0.90	2.63	1.32	1.41	2.88	0.99	1.02
wikis?	3.23	1.11	1.14	3.78	0.79	0.83	4.19	063	0.66
Overall mean	2.81			3.35			3.41		

Table 5.1.1c: Students' ratings of their overall experience with various ICT tools (KS3 n = 25, KS4 n = 12 (9 completed this section), KS5 n = 16)

The overall mean results show an increasingly positive experience of these ICT tools with increasing age. On average, Year 9 rated their experience with blogs, collaborative writing tools, making their own websites, podcasting, social bookmarking and tagging, social photo tools and virtual worlds as slightly negative whereas Year 10 had a much more positive view of social bookmarking, tagging and photo tools. The KS5 students rated virtual worlds, podcasting and collaborative writing tools negatively but indicated that they had positive experiences with the other tools.

All the students appeared to enjoy social networking sites and video sites and the Year 10 students rated their experience with social networking and social video tools as very positive (mean = 5.00). A mean of 5.00 indicates that every student who completed this part of the survey rated their experience with that ICT tool as strongly positive, which may have future implications for teaching and learning and illustrates the importance of e-safety when using webtools with students who may already have an online presence. The large standard deviation for the experience of social photo tools for all groups (and social bookmarking and tagging for KS4 and KS5) may indicate that some students have had a negative experience with being tagged in photographs on, for example, Facebook, Instagram or Flickr already. All groups also thought that their experience of using wikis was positive, with the KS5 group having the most positive experience (mean = 4.19). However, it is unclear whether students considered their use of Wikipedia when responding to this question.

Table 5.1.1c shows that there were many standard deviations larger than 1.15 for this section, indicating that the students had differing opinions of these ICT tools within each group. It was evident to the researcher that the students may have said that they had a negative experience with a tool when they had never used the tool. Anecdotally, some students asked the researcher what podcasting and virtual worlds were, which supports this view. Also, in a later activity, students from a different Year 10 group (Focus Group C) visibly enjoyed podcasting and had not tried this before, so it can be assumed that other Year 10 students had not tried podcasting before either.

In hindsight, an improvement to the questionnaire design would have included a primary question which asked students if they had ever used these ICT tools before and then asked them to rate their experience as a secondary question, if they had responded "yes" to the first. Instead, the frequency of using these tools was determined (see Table 5.1.1d) and the frequency of students choosing the term "Never" confirms that most students surveyed had little experience with webtools outside of social networking. With regards to the research questions, regardless of initial opinion, there appeared to be scope to increase students' experiences with these tools during the course of the study and this early survey allowed for comparison with students' opinions after they had used the webtools and completed their evaluations.

Students' current use of and contributions to Webtools

Table 5.1.1d below summarises the responses from the ICT Survey for KS3, KS4 and KS5 with regards to how often students contribute to various webtools such as blogs, wikis and podcasts. The survey can be viewed in Appendix 2. In this table, the modal response for each Key Stage was highlighted dark grey and any further responses that were considered by the researcher to potentially be significant (4 or more students or 1/3 of the group choosing a particular answer) were highlighted light grey. Of the 25 Year 9 students, 23 completed this section. 8 of the 12 Year 10 students and all 16 of the KS5 students also completed this section.

Statement		Never	Yearly	Monthly	Weekly	Daily
How often do you contribute to a blog?	Year 9	16	1	0	2	5
	Year 10x	5	0	0	1	2
	Year 12/13	12	0	1	1	2
How often do you use collaborative writing tools?	Year 9	13	1	1	7	2
	Year 10x	2	1	0	1	3
	Year 12/13	12	1	3	0	0
How often do you contribute to your own website?	Year 9	15	2	3	2	0
	Year 10x	6	0	0	0	1
	Year 12/13	0	0	15	1	0
How often do you podcast?	Year 9	21	0	1	1	1
	Year 10x	6	0	1	1	1
	Year 12/13	13	1	2	0	0
How often do you use social bookmarking and tagging?	Year 9	11	2	2	5	4
	Year 10x	2	0	2	3	2
	Year 12/13	6	0	3	6	1
How often do you use social photo tools?	Year 9	12	3	3	5	0
	Year 10x	3	1	2	1	1
	Year 12/13	8	0	0	7	1
How often do you post to social networking sites?	Year 9	3	0	2	4	13
	Year 10x	0	0	0	0	9
	Year 12/13	0	0	1	3	12
How often do you post to social video tools?	Year 9	1	0	3	4	15
	Year 10x	0	0	0	0	9
	Year 12/13	0	0	1	8	7
How often do you use virtual worlds?	Year 9	16	2	1	1	3
	Year 10x	8	0	1	0	0
	Year 12/13	14	0	1	1	0
How often do you contribute to wikis?	Year 9	2	1	7	10	3
	Year 10x	1	0	1	5	1
	Year 12/13	0	3	4	6	3

Table 5.1.1d: Students' current use of or contributions to Webtools (KS3 n = 25 (23 completed this section), KS4 n = 12 (8 completed this section), KS5 n = 16)

Students in all Key Stage groups largely stated that they did not contribute to or use the webtools listed in the table, other than social networking and video tools and wikis, which most students (28 of 47) said they contributed to on a daily or weekly basis. Again, it is unclear whether students actually contributed to the wikis or were indicating that they used Wikipedia every week. Students in all groups mostly said that they posted to social video or networking sites on a daily basis (34 of 47 students), which the researcher found unsurprising given the positive experiences the students had with social networking as indicated in Table 5.1.1c.

The least used tools were podcasting and virtual worlds, with which many students, in the previous section, said they had negative experiences. However, when the teacher tried podcasting with a Year 10 Y-band class, the students appeared to enjoy the experience, so this may be an area for further development in the school, and could be the subject of another research project. The results presented in Tables 5.1.1c and 5.11.1d illustrated that students may have been quick to judge a new technology before using it and this was useful information when planning the ICT based tasks for which the results are presented later in the chapter. Although most students in KS3 and KS4 said they did not ever contribute to their own website, it was encouraging that the KS5 students said that they did this on either a monthly or weekly basis, even though none of this group contributed every day. At the time of the survey some students had begun to make their own websites in their Chemistry lessons which accounts for this difference in the KS5 results.

<u>What technologies do students own and use?</u>

The following figures (Figures 5.1.1b and 5.1.1c) illustrate the technologies and hardware that students in the KS3, 4 and 5 groups owned and used. Where the total number of responses for one question did not total the number of participants, this was because students missed this question and did not answer it in the survey. All 25 Year 9 students, all 16 KS5 students, and 10 of the 12 Year 10 students who participated in this survey, completed this section. On this occasion the percentages of each focus group who said "Yes" were used to directly compare the three Focus Groups. The raw data can be viewed in Appendix 10. Figure 5.1.1b shows the percentage of each Key Stage surveyed who had used various pieces of hardware and Figure 5.1.1c shows the percentage of each Key Stage surveyed who owned that piece of hardware.

The abbreviation PDA in the figures below represents Personal Digital Assistant, also known as a palmtop computer. Percentages have been used to compare these pieces of hardware despite the small group sizes as the researcher thought it would aid visual comparison between what students own and use. It should be noted that the number of respondents (n) is indicated under each figure.

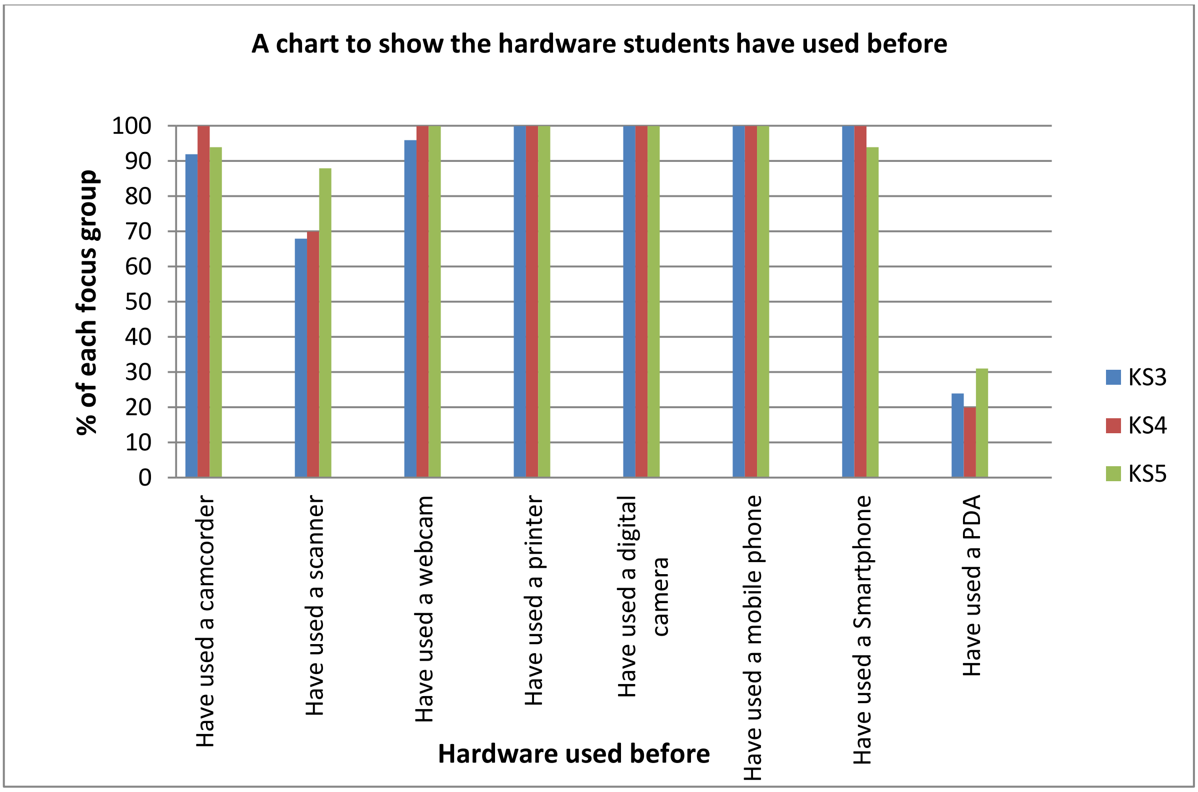

Figure 5.1.1b: What hardware have students used before? (KS3 n = 25, KS4 n = 12 (10 students completed this section but one student missed some questions), KS5 n = 16)

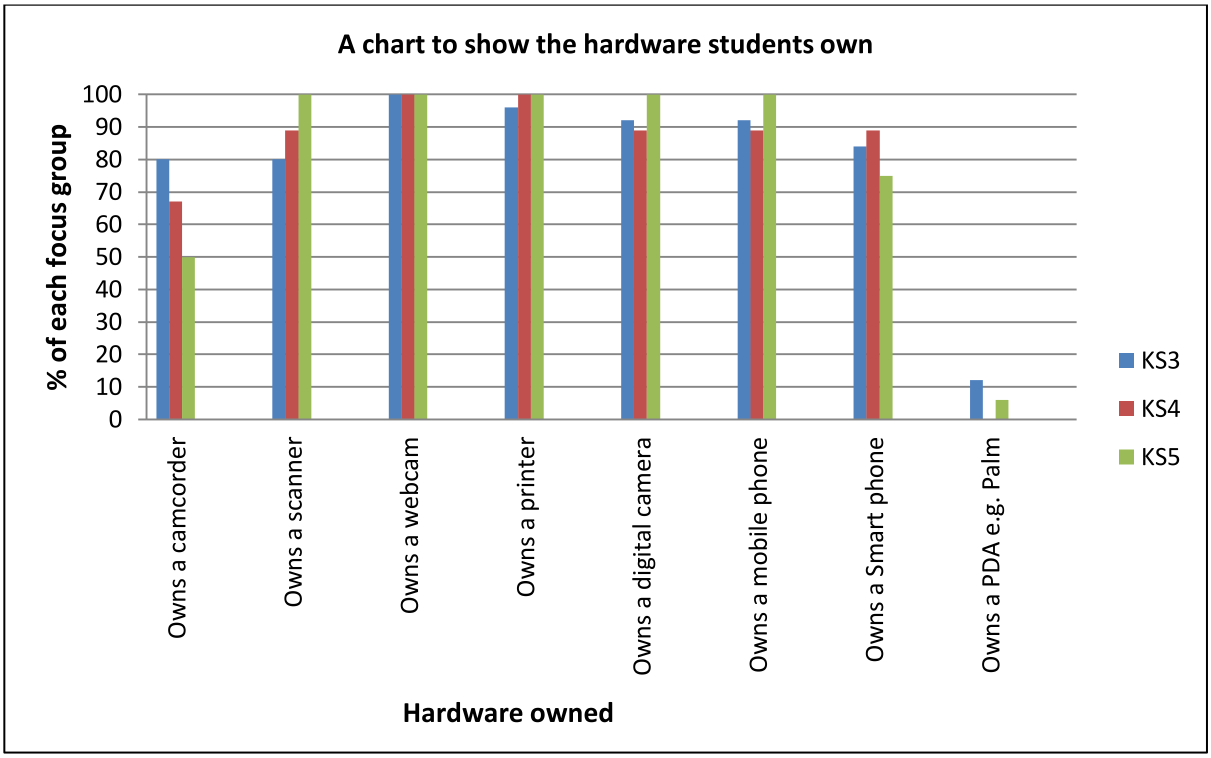

Figure 5.1.1c: What hardware do students own? (KS3 n = 25, KS4 n = 12 (10 students completed this section but one student missed some questions), KS5 n = 16)

Almost all of the students in each Key Stage, in this part of the survey, indicated that they had access to a wide range of technology including smartphones, scanners, printers and webcams. All students said that they owned a webcam and all students had used a printer, digital camera and mobile phone before. Very few students owned or had used a PDA and many did not know what one was. This may be because Smartphones can now access the Internet, e-mail, play music and have most if not all of the functions of a PDA. Some students may have considered the definition of a PDA to include the iPod Touch, whereas others may have considered this to primarily be an MP4 player which could account for the small number of students responding that they had used a PDA but did not own one (they may have other devices with this functionality, for example a Smartphone).

Camcorders were also less popular for all groups, as one could assume that now students prefer to use their smartphones to record movie clips. Even though most students indicated they owned a scanner, some students in each group had never used it. This may be because the students created pictures and documents on the computer, so scanning something in was not necessary as they already had a digital copy, but they owned a combined printer and scanner. These results suggest that most students in these groups have access to all the hardware they require to create digital resources and access online content, should they want to do this, even outside of school.

Students' interest in Webtools

Table 5.1.1e summarises the responses from the KS3, KS4 and KS5 groups to the ICT survey's section concerning which webtools the students are interested in learning how to use. 21 of the 25 Year 9 students, 9 of the 12 Year 10 students and all 16 of the KS5 students completed this section. As was the case in Table 5.1.1d, in the table below the modal response for each Key Stage was highlighted dark grey and any further responses that were considered by the researcher to potentially be significant (4 or more students or 1/3 of the group choosing a particular answer) were highlighted light grey.

Which webtools are students interested in learning to use?		Year 9 KS3	Year 10x KS4	Year 12/13 KS5
Are you interested in learning how to use blogs?	Yes	9	5	8
	No	5	3	6
	Unsure	6	1	2
Are you interested in learning how to use collaborative writing tools?	Yes	9	5	7
	No	4	3	5
	Unsure	8	1	4
Are you interested in learning how to make your own websites?	Yes	11	6	10
	No	5	2	3
	Unsure	5	1	3
Are you interested in learning how to do podcasting?	Yes	8	6	5
	No	4	2	10
	Unsure	9	1	1
Are you interested in learning how to use social bookmarking/tagging?	Yes	10	6	7
	No	5	3	7
	Unsure	6	0	2
Are you interested in learning how to use social photo tools?	Yes	9	5	8
	No	5	2	6
	Unsure	7	1	2
Are you interested in learning how to use social networking sites?	Yes	15	8	10
	No	3	1	5
	Unsure	3	0	1
Are you interested in learning how to use social video tools?	Yes	15	8	11
	No	3	1	4
	Unsure	3	0	1
Are you interested in learning how to use virtual worlds?	Yes	8	7	5
	No	4	1	9
	Unsure	9	1	2
Are you interested in learning how to use wikis?	Yes	13	8	11
	No	2	1	3
	Unsure	6	0	2

Table 5.1.1e: Webtools students want to learn how to use (KS3 n = 25 (21 completed this section), KS4 n = 12 (9 completed this section), KS5 n = 16)

In all age groups, students indicated that they would like to learn how to use wikis, social video tools and social networking sites and they would like to know how to make their own websites. Students were less sure about the other tools, especially podcasting and virtual worlds. It was possible that these students did not know what podcasting was or they may have thought they would prefer to try video recording.

It is curious that interest in using virtual worlds was high in the Year 10 group but low in the KS5 group. A similar pattern was found with podcasting. Social networking, bookmarking and video tools also seemed more popular with KS3 and KS4 students than KS5. The researcher suggests that this could be due to increased time spent on study at KS5, or perhaps these students viewed computers as tools for work rather than for social activity. It could also be that KS5 students have a greater awareness of the potential issues associated with an increased virtual presence and so prefer not to participate in virtual worlds or social networking.

The majority of students in each group indicated that they would like to learn how to make their own websites (27 of 46 students) and wikis (32 of 46 students), which relates to the research questions and indicates potential for further work in this area with these groups.

5.1.2 Year 9 Wikispaces Evaluation

The results below are those of Focus Group A which consisted of a form of 30, mixed ability Year 9 students, in the 13-14 year age range. Ability and achievement levels for this group can be seen in Chapter 3. There were 17 females and 13 males. One female student and one male student were absent during the survey so 28 students completed the Wikispaces Evaluation Survey which can be viewed in Appendix 2. The students were asked to respond to a range of statements about the Wikispaces wiki and the lesson and responded via a Likert scale, the results of which are summarised in Table 5.1.2a below.

The Likert scale responses for Table 5.1.2a were as follows: 1 = Strongly Disagree, 2 = Slightly Disagree, 3 = Neutral, 4 = Slightly Agree, 5 = Strongly Agree. Positive responses were highlighted green and negative responses were highlighted orange to aid visual comparison. Students were also given the opportunity to write qualitative responses to some questions which are summarised in Table 5.1.2c.

ID	Gender	Age	The graphics and animations from the website helped me to learn	I felt I was able to learn from the website	The website was easy for the teacher to set up	The website was easy to learn how to use and navigate	I found the website instructions clear	I liked interacting with the activities on the website	I was on task while using the website	I felt motivated whilst using the website	I would visit the website again for revision purposes
01	M	14	4	4	5	5	5	5	5	4	5
02	F	14	3	4	4	4	4	4	4	4	4
03	F	13	3	2	3	4	3	3	4	2	2
04	F	14	4	4	4	4	4	4	4	4	4
05	F	13	3	4	5	5	5	4	4	4	3
06	F	14	3	4	5	4	4	5	5	4	4
07	F	14	3	3	4	4	5	4	5	4	5
08	M	14	3	4	5	4	5	4	4	3	4
09	F	14	1	4	4	5	5	3	4	4	5
10	M	13	2	3	4	2	3	3	3	3	3
11	M	14	3	3	5	4	3	3	3	3	3
12	M	13	2	3	4	4	3	4	2	2	3
13	M	13	3	3	5	5	5	3	5	5	5
14	M	14	4	4	3	3	4	5	3	4	5
15	F	13	4	5	3	5	5	5	4	4	5
16	F	14	3	3	3	4	3	2	5	4	2
17	M	13	4	4	5	4	5	4	5	5	5
18	M	13	5	3	4	5	4	3	4	5	3
19	M	13	4	3	4	5	3	3	4	3	4
20	F	13	4	4	5	4	4	5	4	4	4
21	F	14	5	4	5	5	4	4	5	5	5
22	M	14	3	4	4	4	4	4	4	4	4
23	F	14	3	3	3	4	4	3	4	3	4
24	F	14	3	2	3	4	3	3	4	2	2
25	F	14	5	5	5	5	5	5	5	5	5
26	M	13	1	5	5	4	4	4	4	4	4
27	F	13	5	5	5	5	5	5	5	5	5
28	F	14	3	4	5	5	5	5	5	3	3

Table 5.1.2a: Likert scale responses for Year 9 Wikispaces Evaluation Survey (n = 28)

This raw data suggest that students generally felt positively about the Wikispaces wiki. Two students (Student IDs: 4, 25 and 27) chose the same response for all the statements which may indicate that they rushed through this section of the survey or they felt generally positive about the lesson. No students disagreed with the statements concerning the ease of setting up the website and the clarity of instructions. The most disagreement was with the statement "*The graphics and animations from the website helped me to learn"* with only 11 of the 28 students agreeing with this statement.

Table 5.1.2b summarises the means and standard deviations of the responses to this survey and is colour coded to ease visual comparison. For the 'Mean' column: Dark green = 4.01 – 5.00, indicating a strongly positive response; Light green = 3.01 – 4.00, indicating a slightly positive response; Yellow = 3.00, indicating a neutral response; Orange = 2.00 – 2.99, indicating a slightly negative response and Red = 1.00 – 1.99, indicating a strongly negative response. For the 'Population SD' (Standard Deviation) columns: Dark green = 0.00 – 0.50 indicating a narrower spread of results; Light green = 0.51 – 0.70; Yellow = 0.71 – 0.90; Orange = 0.91 – 1.10 and Red = 1.10 + indicating a wider spread of results.

The reasons for using this colour code for these tables and the justification for using this method of analysis was previously discussed at the start of this chapter. For all other means and standard deviations tables in this chapter the same colour coding has been employed to ensure consistency when comparing data sets.

Statement	Mean	Population SD	Sample SD
The website was easy to learn how to use and navigate	4.29	0.70	0.71
The website was easy for the teacher to set up	4.25	0.78	0.80
I was on task while using the website	4.18	0.76	0.77
I found the website instructions clear	4.14	0.79	0.81
I would visit the website again for revision purposes	3.93	1.00	1.02
I liked interacting with the activities on the website	3.89	0.86	0.88
I felt motivated whilst using the website	3.79	0.90	0.92
I felt I was able to learn from the website	3.68	0.80	0.82
The graphics and animations from the website helped me to learn	3.32	1.04	1.06
Overall mean	3.94		

Table 5.1.2b: Year 9 Wikispaces Evaluation Survey Responses – Means and Standard Deviations (n = 28)

The mean responses to the survey also indicated that the students felt positively about the Wikispaces wiki as the overall mean was 3.94. The students felt that the website was easy to learn how to use and navigate (mean = 4.29, SD = 0.71) and this was significant to the researcher. The most important question was "*I felt I was able to learn from the website*", which produced, on average, a positive response from most of the students (mean = 3.68, SD = 0.82). Many also thought that the wiki had been easy for the teacher to set up (mean = 4.25, SD = 0.78) and that they were on task and the website instructions were clear. Caution should be exercised here as the students may have been biased towards the teacher.

The students also responded positively to the statement "*I would visit the website again for revision purposes*" (mean = 3.93) although the standard deviation was higher for this statement, indicating that some students were less keen to revisit their work. The least positively ranked comment was regarding the graphics and animations on the wiki. In class, the students seemed to like websites that were animated, bright and colourful, although with a standard deviation of 1.06, this indicated that this was more important to some students than others. However, this may be an area for improvement when developing other wikis. This was also highlighted in the student comments (see Table 5.1.2c), with three students stating that making the website more colourful would make using the website easier and two students indicating that adding pictures would also assist in this. These and other qualitative responses to the Wikispaces Evaluation Survey are categorised in Table 5.1.2c.

In this and subsequent qualitative response tables the reader may, unless stated, assume that each comment was made by one student. As stated earlier in the chapter, the qualitative data were categorised into positive and negative responses concerning:

- Technology – features controlled by the Teacher
- Technology – features not controlled by the Teacher
- Teaching and Literacy comments
- Learning and Engagement comments
- Personal and Social comments, although there were no comments of this nature

	Positive Comments	Negative Comments and Advice	
Technology - features not controlled by the Teacher	There were no technology based problems that I encountered while using the website (26 students)	Make it easier to link your own page to the group's page	The website could be improved by using an autosave feature
		An easier editing surface would make using the website easier	The website could be improved by having more graphic interchanging formats/making it easier to put pictures on/range of fonts (2 students)
Technology - features controlled by the Teacher		More pictures would make using the website easier (2 students)	Making the website more colourful would make using the website easier (3 students)
		I would make it easier by linking it to the year 9 page so it is easier to access	The website could be improved by making it easier to direct around the site
		The website could be improved by the teacher by adding videos/animations (7 students)	The website could be improved by having a better layout
Learning and Engagement	Nothing would make using the website easier in the future/ It is already easy (8 students)	More directions /instructions /a website tour would make using the website easier (5 students)	More time to develop my wiki page would make using the website easier/If you went on it more times
	Using websites is good because I learn more	The website could be improved by having clearer instructions (5 students)	The website could be improved by putting activities on the computer instead of doing it in the classroom
	Use it more/keep doing it (5 students)	The website was a little confusing	Give more information
	Pupils are more focused and concentrate more knowing that someone is watching it	The website could be improved by having some science links/webpages/revision sites (7 students)	The website could be improved if we could learn how to do more advanced technology
	It's a good opportunity and a good way of learning		
Teaching and Literacy		Give advice to teachers on how to use websites/Teachers need to be competent with them (3 students)	The website could be improved if we were taught/shown more things about the website
		Teachers should explain why we use websites	Explain to the whole class how to link videos and animations

Table 5.1.2c: Analysis of written responses for Year 9 Wikispaces Evaluation (n = 28)

In answer to the question "*How could the website be improved by the teacher to help students to learn*", one student stated: "*Make it more stand out e.g. Colourful*" (Student ID: 15) and another said "*range of fonts, easier to put pictures on*" (Student ID: 2) which supports the quantitative data and suggests that the teacher should not underestimate the importance of graphics when designing an engaging ICT-based resource for students.

With regard to students' learning, several students indicated that the Wikispaces wiki had helped them to learn, with comments such as: "*Using websites is good because I learn more*", "*It's a good opportunity and a good way of learning*" and "*Pupils are more focused and concentrate more knowing that someone is watching it*" featuring in the qualitative responses. One student said that an improvement would be more time spent on the wiki to develop the page and another indicated that the wiki could also be used in the classroom.

It is worthy of note that the statement which received the highest mean and smallest standard deviation, "*The website was easy to learn how to use and navigate*", also featured negatively many times in the student comments, with 5 students explaining that more directions or instructions or a website tour would make using the website easier to use and 5 students also suggesting that the website could be improved by having clearer instructions. One student even commented that the website *"…was a little confusing*" (Student ID: 16). This suggests that regardless of how easy a website is to navigate, students will often need a demonstration of a new site or a written set of instructions to follow, and the researcher considers this to be an important teaching and learning point.

There appears to be no correlation between the negative comments and gender or ability with both male and female students making similar statements and making similar suggestions. Only one female student said that the website was confusing. The written statements made by the students, correlate well with the numerical data. The largest standard deviation (1.06) was for the statement "*The graphics and animations from the website helped me to learn*" and this was the most commented on aspect as well. It appeared that the Wikispaces site was robust and worked consistently well throughout the lesson as 26 students commented that they encountered no technology based problems whilst using the wiki. There were also many comments regarding Wikispaces features over which the teacher had no control, for example "*The website could be improved by using an autosave feature*", and other comments regarding the editing and graphics functionality were mentioned in the written responses.

5.1.3 Year 9 Kerboodle Evaluation

Kerboodle (www.kerboodle.com) is a commercial, online teaching resource and website which describes itself as having:

> "*The best online resources to enable you to teach your subject, the way you want to and to the depth you need to, so that your students achieve the GCSE and A Level results they are capable of*."

The results presented in this section and section 5.1.4 may be used to help to answer the research question "*What are secondary school students' perceptions of using commercial sites e.g. Kerboodle in science lessons?"* and may also provide a comparison to the teacher generated websites trialled by Focus Groups A and B.

Kerboodle was tested on both Focus Groups A and C. The results overleaf are those of Focus Group A which consisted of a form of 30, mixed ability Year 9 students, in the 13-14 years age range. There were 17 females and 13 males in the group but 3 male students were absent during the survey so 27 students completed the Kerboodle Evaluation Survey which can be viewed in Appendix 2. Ability and achievement levels for this group can be seen in Chapter 3. The Likert scale responses for Table 5.1.3a were as follows: 1 = Strongly Disagree, 2 = Slightly Disagree, 3 = Neutral, 4 = Slightly Agree, 5 = Strongly Agree. Positive responses were highlighted green and negative responses were highlighted orange to aid visual comparison.

ID	Gender	Age	The graphics and animations from Kerboodle helped me to learn	I felt I was able to learn from Kerboodle	Kerboodle was easy for the teacher to set up	Kerboodle was easy to learn how to use	I found the Kerboodle instructions clear	I liked interacting with the Kerboodle tools	I was on task while using Kerboodle	I felt motivated whilst using Kerboodle
29	F	14	5	5	5	5	5	5	5	5
30	M	13	4	5	4	4	5	5	5	5
31	F	13	5	5	5	5	5	5	5	5
32	F	14	5	5	4	5	5	4	5	4
33	F	13	3	5	5	5	5	5	4	5
34	M	14	3	4	3	3	4	4	4	4
35	F	13	3	4	5	5	5	5	4	4
36	M	13	4	5	5	5	5	5	5	5
37	F	14	4	4	4	4	4	4	4	4
38	F	14	5	4	4	4	4	4	4	4
39	M	13	5	4	4	4	4	4	4	4
40	M	14	4	5	5	5	5	5	4	4
41	M	13	5	5	5	5	5	5	4	5
42	F	13	5	5	5	5	5	5	3	5
43	F	13	4	5	5	5	5	5	5	4
44	F	14	4	5	5	4	3	5	5	4
45	F	14	4	5	4	5	5	5	5	5
46	F	13	4	3	5	4	5	5	4	4
47	F	13	4	5	5	3	3	4	4	4
48	M	13	5	5	5	5	5	5	3	4
49	F	13	5	5	5	5	5	5	5	5
50	M	14	4	5	4	5	5	5	4	5
51	F	14	5	5	5	5	5	5	5	4
52	M	13	3	5	4	3	3	3	4	3
53	F	14	5	5	5	5	5	5	4	5
54	F	13	4	5	4	4	4	5	5	5
55	M	14	4	5	4	5	5	4	4	5

Table 5.1.3a: Likert scale responses for Year 9 Kerboodle Evaluation Survey (n = 27)

As can be seen in Table 5.1.3b, there were few “3” and no “2” or “1” responses to this survey, indicating that students either slightly or strongly agreed with the statements about the Kerboodle site. This group were generally extremely positive about Kerboodle and there were no negative responses made by any student. One male student made 5 neutral responses, possibly indicting apathy and the statement with the most neutral responses was: “*The graphics and animations from Kerboodle helped me to learn*” (4 students). However, most students made no negative responses. 4 students chose the same response for all of the statements (either 4 or 5) which may indicate that they rushed through this part of the survey or felt generally positive about the lesson.

Table 5.1.3b summarises the means and standard deviations of the responses to this survey. Although the table is colour coded as in section 5.1.2, the whole table is green due to the large mean and small standard deviations of the responses.

Statement	Mean	Population SD	Sample SD
I felt I was able to learn from Kerboodle	4.74	0.52	0.53
I liked interacting with the Kerboodle tools	4.67	0.54	0.55
I found the Kerboodle instructions clear	4.59	0.68	0.69
Kerboodle was easy for the teacher to set up	4.56	0.57	0.58
Kerboodle was easy to learn how to use	4.52	0.69	0.70
I felt motivated whilst using Kerboodle	4.44	0.57	0.58
I was on task while using Kerboodle	4.33	0.61	0.62
The graphics and animations from Kerboodle helped me to learn	4.26	0.70	0.71
Overall mean	4.51		

Table 5.1.3b: Year 9 Kerboodle Evaluation Survey Responses – Means and Standard Deviations (n = 27)

The mean responses to this survey were very positive, with the lowest mean 4.26, and an overall mean of 4.51. During the lesson the teacher observed that the students visibly appeared to enjoy using Kerboodle more than Wikispaces. This was also indicated by the means of the Likert scale responses, which were higher than for the same statements about the Wikispaces wiki. The standard deviations of these responses were also smaller for the Kerboodle evaluation, indicating that the students had a more consistent view of the Kerboodle website.

The statement which received the highest mean and the smallest standard deviation was "*I felt I was able to learn from Kerboodle*" (mean = 4.74, SD = 0.53) and when compared to the same statement made about Wikispaces (mean = 3.68, SD = 0.80) this suggests that Kerboodle was perceived to be a more effective teaching and learning tool for this group of students, which partially answers the first research question and also indicates an answer to the third; that ICT based teaching tools do contribute positively to students' learning.

The least positive statement again concerned the graphics and animations (mean = 4.26, SD = 0.70) although it appeared that the students preferred how Kerboodle had incorporated animations to how the Wikispaces wiki had used them. The students commented that the videos on Kerboodle did not work and despite this, two students requested that videos and more interaction should be included. Twenty two students indicated that they had no technology based problems which implied that the video issue may have been a problem with an individual computer rather than the website. There appeared to have been more technology based problems with Kerboodle than the Wikispaces wiki, however, it seemed to have been more popular as 10 students requested that Kerboodle was used more often. One student stated "*I think that they should use it more often because it's a fun way of learning.*" (Student ID: 51)

Although the group indicated strongly that Kerboodle was easy to learn how to use (mean 4.52, SD = 0.69) there were again many comments from students suggesting how to make it easier, such as tutorials, clearer instructions and ways of making it easier to find different things. Table 5.1.3c below summarises the qualitative comments from this survey and categorises them as previously described. Again, if no number follows a comment, assume the statement was made by one student.

<table>
<tr><th></th><th>Positive Comments</th><th colspan="2">Negative Comments and Advice</th></tr>
<tr><td rowspan="4">Technology - features not controlled by the Teacher</td><td>People would probably be more interested because it's on computer and it's quite a fun site. I liked that there was pens that we can draw on the book and it looks like an actual book itself</td><td>The videos didn't work</td><td>More interactive games would make it easier to use</td></tr>
<tr><td>I enjoyed the activities and how all the topics were easy to access. I really enjoyed the fact that there were revision books.</td><td>It would be easier to use if it worked better</td><td>More animations would make it easier to use</td></tr>
<tr><td>It is easy to use (5 students)</td><td>If you could write in text boxes on Kerboodle books would make it easier to use (2 students)</td><td>Include videos and more interaction (2 students)</td></tr>
<tr><td>There were no technology based problems when using the website (22 students)</td><td>An easier pen tool on the library would make it easier to use</td><td>Making the list clearer when looking for tasks would make it easier to use</td></tr>
<tr><td>Technology - features controlled by the Teacher</td><td></td><td>Clearer instructions would make it easier to use and how to get to places needs to be clearer</td><td>Making it easy to find different things would make it easier to use (3 students)</td></tr>
<tr><td rowspan="7">Learning and Engagement</td><td>Better than text books, learning more free</td><td>Use it because it can help, if teachers teach and we use it at the same time, I think we will work better to learn</td><td>We could use it in class (2 students)</td></tr>
<tr><td>I learnt how to log in and I found it good at looking at books and being able to do practical things with the computer</td><td rowspan="6">The interactive activities helped me to understand the tasks more than other activities.</td><td rowspan="6">Tutorials for how to get where if you are new to it would make it easier to use</td></tr>
<tr><td>It is a fun and easy to use website that will help with revising/learn new things (3 students)</td></tr>
<tr><td>In the future it will make revising for tests remember-able, fun and easy.</td></tr>
<tr><td>I think it's easier for students. I find it more interesting and it keeps me more on task.</td></tr>
<tr><td>Helps us focus more, we learn more</td></tr>
<tr><td>I could use it to revise at home (2 students)</td></tr>
<tr><td rowspan="2">Teaching and Literacy</td><td rowspan="2">Use it a lot more often, use more of the activities in classroom lessons and set tasks for students to complete. I really enjoyed this lesson and the website and will carry on using it at home as well in the future!</td><td>Tell everyone as a group what the task is</td><td rowspan="2">Get print outs</td></tr>
<tr><td>Give us an exam</td></tr>
<tr><td rowspan="4">Personal and Social</td><td>It was very good</td><td rowspan="4" colspan="2">Only use it sometimes</td></tr>
<tr><td>I enjoyed it, it was fun and interesting</td></tr>
<tr><td>More fun than writing, text books</td></tr>
<tr><td>Use it more (10 students)</td></tr>
</table>

Table 5.1.3c: Analysis of written responses for Year 9 Kerboodle Evaluation (n = 27)

These written responses confirm what was shown by the numerical data. There were fewer negative responses for Kerboodle than Wikispaces and the overall mean for Kerboodle (mean = 4.51) was also higher than for Wikispaces (mean = 3.94). The largest standard deviation was again for the statement "*The graphics and animations from Kerboodle helped me to learn"* (SD = 0.71) which explains the few negative comments about the videos and suggestions for more animations. The most common negative comment was that clearer instructions were needed although this is not supported by the numerical data as the statements "*I found the Kerboodle instructions clear*" and "*Kerboodle was easy to learn how to use*" both had mean responses of over 4.5. This suggests that it may not matter how easy the website is to use; students will still require a walkthrough of the site by the teacher! It is possible that the students were trying to give other teachers some advice and this had been done particularly well in the lesson.

It is perhaps not surprising that this group of students found a commercial ICT resource to be better than a teacher-generated site, given that for a commercial resource much money and time has been spent creating student-friendly activities. However, as the next section shows, other problems may arise when using a commercial resource in lessons. The tables of data in the next section may be compared directly with those in this section as the same task was undertaken with both Focus Group A (this group) and Focus Group C (in the next section).

5.1.4 Year 10 Kerboodle Evaluation

This section describes the responses of Focus Group C to the Kerboodle Evaluation Scale survey. This group consisted of 27 students; 9 from each of a higher, middle and lower achieving GCSE science class in the Year 10, Y band. The students were selected at random, as detailed earlier in the research design, to complete the survey. These three groups completed the same style of revision lesson as the previous Year 9 class. These results, which were more varied than those of the Year 9 group, are discussed further in Chapter 6. The Likert Scale used in Table 5.1.4a below was as follows: 1 = Strongly Disagree, 2 = Slightly Disagree, 3 = Neutral, 4 = Slightly Agree, 5 = Strongly Agree. The positive responses were highlighted green and the negative responses were highlighted orange.

ID	Gender	Set	Age	The graphics and animations from Kerboodle helped me to learn	I felt I was able to learn from Kerboodle	Kerboodle was easy for the teacher to set up	Kerboodle was easy to learn how to use	I found the Kerboodle instructions clear	I liked interacting with the Kerboodle tools	I was on task while using Kerboodle	I felt motivated whilst using Kerboodle
56	M	10Y3	15	3	2	3	2	3	3	2	1
57	F	10Y3	15	4	2	3	1	2	2	2	1
58	F	10Y3	14	2	3	1	2	2	1	1	1
59	M	10Y3	14	2	3	2	4	2	2	2	1
60	M	10Y3	14	3	3	3	3	3	3	3	2
61	M	10Y3	14	4	2	2	3	3	4	1	1
62	M	10Y3	15	1	2	3	4	5	4	3	2
63	F	10Y3	15	3	2	4	5	5	4	2	1
64	F	10Y3	14	3	3	5	4	4	3	1	1
65	F	10Y2	15	3	4	5	4	5	4	3	3
66	F	10Y2	14	4	4	4	4	4	4	4	4
67	F	10Y2	14	4	4	4	3	4	4	4	3
68	M	10Y2	14	4	5	5	3	3	4	4	4
69	M	10Y2	15	5	5	5	3	3	4	4	3
70	M	10Y2	15	4	4	4	4	3	3	4	4
71	M	10Y2	14	4	3	4	3	2	4	4	2
72	M	10Y2	15	4	4	2	5	5	3	3	2
73	F	10Y2	15	3	3	5	4	3	3	2	2
74	M	10Y1	15	3	4	2	3	4	3	4	2
75	F	10Y1	15	5	4	4	3	3	5	5	5
76	F	10Y1	14	4	4	3	4	4	4	4	3
77	F	10Y1	15	4	3	5	5	4	4	3	3
78	M	10Y1	15	4	5	4	5	5	5	5	4
79	M	10Y1	15	4	4	5	5	5	4	4	3
80	F	10Y1	14	4	4	5	5	5	4	4	4
81	M	10Y1	14	4	5	4	3	4	5	4	3
82	F	10Y1	15	4	5	4	4	5	5	5	4

Table 5.1.4a: Likert scale responses for Year 10 Kerboodle Evaluation Survey (n = 27)

It is immediately evident that the students in 10Y3 had a different experience with Kerboodle than students in 10Y2 and 10Y1. Only 3 students in 10Y2 (2 male and 1 female) and one male student in 10Y1 disagreed with any of the statements but all 9 students in 10Y3 disagreed with at least one of the statements. One female student (Student ID: 66) slightly agreed with all of the statements which may indicate that she rushed through this section or may have felt positively in general about the lesson. Table 5.1.4b shows the means and standard deviations of these responses.

Statement	Mean	Population SD	Sample SD
Kerboodle was easy for the teacher to set up	3.70	1.15	1.17
I found the Kerboodle instructions clear	3.70	1.05	1.07
Kerboodle was easy to learn how to use	3.63	1.02	1.04
I liked interacting with the Kerboodle tools	3.63	0.95	0.97
The graphics and animations from Kerboodle helped me to learn	3.56	0.87	0.89
I felt I was able to learn from Kerboodle	3.56	0.99	1.01
I was on task while using Kerboodle	3.22	1.20	1.22
I felt motivated whilst using Kerboodle	2.56	1.20	1.22
Overall mean	3.45		

Table 5.1.4b: Year 10 Kerboodle Evaluation Survey Responses – Means and Standard Deviations (n = 27)

The Likert scale responses' means indicated that the students responded positively to most of the statements although the much larger standard deviations suggest that there was a larger difference in how the students felt about Kerboodle in the Year 10 groups than in the Year 9 class. This is visually evident from Table 5.1.4a when compared with Table 5.1.3a. No student in the Year 9 class disagreed with any of the statements and no students had any technology-based issues. All the Year 9 students logged in easily and there were no problems with a slow Internet connection. It is worth noting that this group completed the Kerboodle lessons in one of the GCSE ICT teaching rooms with newer computers, whereas the Year 10 students had to use a less modern, Religious Education computer room.

The students in the Year 10 groups indicated that they did not feel as motivated when using Kerboodle than the students in the Year 9 group did; although as there was a large standard deviation of 1.20 for this statement, motivation may have been greater in some classes than others and further analysis of the raw data indicated that the negative responses came from the lower achieving 10Y3 students. The meaning of the term "motivation" is discussed earlier in the research design but largely relates to the students' interest in and enthusiasm in the lessons, or the students' willingness to complete the tasks. The researcher noted that fewer students in 10Y3 were enthusiastic about using Kerboodle and fewer were interested in completing all the tasks set. Even students who had no problems with logging in became increasingly distracted. One 10Y3 male student (who was not part of the random sample) commented during the lesson that he disliked using online revision resources because he found "*the rest of the Internet very distracting*" which may provide some insight into the rest of the 10Y3 sample group's behaviour.

In a similar vein, 10Y3 students also thought that they were less on task than the students surveyed in 10Y1 and 10Y2. An inspection of the student comments (see Table 51.4c) suggests a reason for this off-task behaviour. It appears that many students experienced technology based issues in the lesson. Six students said that the "*Internet was slow*" and some either took a long time to log in (2 students) or could not log in at all (3 students). Two students could not get their computer to turn on or connect to the Internet. It was clear to the teacher that this lower achieving group became frustrated quickly with these issues and quickly became demotivated. The group complained verbally that the pages would not load quickly enough for them and it was clear that many students became impatient. No significant difference was found between the Likert scale responses given by males and females in this survey analysis, although more male students had forgotten their passwords or had issues with logging on (6 students) than female students (3 students).

The problems experienced with this group have strong implications for teaching and learning. The robustness of any webtool must be thoroughly tested before use with students and if logging in or bandwidth problems are likely, a suitable alternate activity must be planned into the lesson by the teacher. If students have similar issues with accessing the webtool outside of school they may be disinclined to complete their homework, or may use the slow performance as an excuse for not attempting their homework assignment at all. Table 5.1.4c below summarises the qualitative responses to the survey. Again, comments are made by one pupil unless indicated otherwise. As can be seen, there are a large number of negative responses, and few positive responses, which is different to the larger number of positive responses seen in the equivalent table for the Year 9 group (Table 5.1.3c). Most of the negative responses relate to problems over which the teacher had little control, such as a slow Internet connection or navigation within Kerboodle.

<table>
<tr><th></th><th>Positive Comments</th><th colspan="2">Negative Comments and Advice</th></tr>
<tr><td rowspan="9">Technology - features not controlled by the Teacher</td><td rowspan="9">There were no technology based problems (9 students)</td><td>Password issues</td><td>Internet was slow (6 students)</td></tr>
<tr><td>Could not log on (3 students)</td><td>Computer wouldn't turn on/no Internet connection (2 students)</td></tr>
<tr><td>Took a long time to log in (2 students)</td><td>Don't use it; use BBC Bitesize (2 students)</td></tr>
<tr><td>It loaded really slowly and random useless boxes appeared that wouldn't even go away even when I clicked on the X loads</td><td>It would be easier if the site had a more accessible order of the pages as it is difficult to find the right page</td></tr>
<tr><td>It would be easier if you could highlight recently used</td><td>Make it easier to use/easier navigation/easier buttons (5 students)</td></tr>
<tr><td>Have more easier but fun interactive tasks</td><td>It would be easier to use if there were more games and activities rather than written questions</td></tr>
<tr><td>It should have more questions and games</td><td>It would be easier to use if the worksheets and different activities were in different categories</td></tr>
<tr><td>It would be easier to use if there were better labelled sections and faster loading</td><td>I think that the layout should be different so that the courses you go on are more explanatory instead of "chemistry 1", "chemistry 2", "chemistry 3" etc.</td></tr>
<tr><td>Website froze (2 students)</td><td>Make it more colourful and presentable/look more appealing (3 students)</td></tr>
<tr><td rowspan="2">Technology - features controlled by the Teacher</td><td rowspan="2"></td><td rowspan="2">Make sure everybody knows their log in beforehand</td><td>Have student passwords ready (4 students)</td></tr>
<tr><td>Ensure the students can use the site/log on (3 students)</td></tr>
<tr><td rowspan="2">Learning and Engagement</td><td rowspan="2">Use it/do more activity on it (2 students)</td><td>Only use it for revision</td><td rowspan="2">I think they should set up games and activities to do instead of filling out loads of worksheets</td></tr>
<tr><td>Make it easier to access homework set</td></tr>
<tr><td rowspan="4">Teaching and Literacy</td><td rowspan="4">Carry on as normal; you’re doing a great job</td><td>Write on the board to show us what to go on</td><td rowspan="2">Prepare the lesson well beforehand or give the students complete freedom</td></tr>
<tr><td>Make clearer which tasks to do (2 students)</td></tr>
<tr><td>Give direct instructions how to get there; it’s easy to get lost</td><td>Learn all the useful functions</td></tr>
<tr><td>Explain how to use site better/clearer instructions (7 students)</td><td>Ensure all pupils are always on task and at least completing one activity</td></tr>
</table>

Table 5.1.4c: Analysis of written responses for Year 10 Kerboodle Evaluation (n = 27)

It was clear to the teacher that the Kerboodle user names and passwords were too complex for the lower achieving class to input. Their user names consisted of their first initial, capitalised, then their surname, capitalised. Their password was the same but with a three digit number after their surname. This created huge issues as some students did not know what a surname was; others forgot to capitalise their name and/or initial; some wrote the number in both the user name and password boxes, whereas some omitted the number entirely. The teacher had to solve each of these problems individually and ended up changing the passwords of at least five students to something simpler. This was a time-consuming process and led to 4 students commenting in the qualitative responses (see Table 5.1.4c) "*Have student passwords ready*".

These log-in problems were not experienced by the other Year 10 groups however, although due to these issues, the 10Y3 students gained some insight into how difficult it had been for the Head of Department to set up the user names and passwords. As there had been no such issues with the Year 9 class, the mean for the statement "*Kerboodle was easy for the teacher to set up*" was 4.52 compared to 3.70 (SD = 1.15) for the Year 10 group. The science teacher also personally felt that Kerboodle had made the setting up procedure unnecessarily complicated.

To conclude, the researcher felt that the volume of negative comments accurately reflected the problems that the Year 10 students experienced when using Kerboodle. It is suggested at this point that the likelihood of experiencing technology based problems may increase as the amount of control the teacher has over the website decreases.

5.1.5 Year 10 Website Evaluation

This section details the responses of Focus Group B to the questions in the Website Evaluation Scale Survey which can be found in Appendix 2. This group consisted of 17 students in a middle set Year 10, X band (half of the Year 10 cohort), GCSE Science class. This was an opportunistic sample, and as the number of students in the group is also low, less value may be able to be placed on the statistical data for this group. These data have been included as anecdotal evidence and may provide hints when designing a website for students. The Likert Scale used in Table 5.1.5a below was as follows: 1 = Strongly Disagree, 2 = Slightly Disagree, 3 = Neutral, 4 = Slightly Agree, 5 = Strongly Agree. The positive responses were highlighted green and the negative responses were highlighted orange.

ID	Gender	Age	The graphics and animations from the website helped me to learn	I felt I was able to learn from the website	The website was easy for the teacher to set up	The website was easy to learn how to use and navigate	I found the website instructions clear	I liked interacting with the activities on the website	I was on task while using the website	I felt motivated whilst using the website
113	F	14	4	5	5	5	4	4	5	5
114	M	15	3	5	3	5	5	4	5	5
115	M	14	5	5	5	5	5	5	4	4
116	M	14	4	3	5	5	5	3	4	4
117	F	14	4	5	5	5	5	5	4	5
118	F	14	5	5	3	4	3	5	5	5
119	F	14	5	4	4	4	4	3	3	5
120	M	14	3	4	3	3	4	3	4	4
121	M	14	5	4	4	4	4	3	3	4
122	F	14	5	5	5	4	2	5	4	4
123	F	14	4	5	5	5	3	5	5	4
124	F	15	4	4	4	5	3	4	4	2
125	F	15	1	5	5	5	5	5	5	4
126	F	15	1	5	5	5	5	5	5	4
127	F	15	5	5	5	5	5	5	5	5
128	F	14	3	4	5	5	5	5	5	5
129	M	14	3	3	3	3	3	3	3	3

Table 5.1.5a: Likert scale responses for Year 10 Website Evaluation Survey (n = 17)

This group generally felt positively about all the aspects of the website. The only statement to which any student strongly disagreed concerned the graphics and animations. One female student agreed strongly with all the statements (Student ID: 127) which may indicate that she enjoyed the lesson very much, but may also mean that she rushed through the survey. One male student responded neutrally to all of the statements (Student ID: 129) which may suggest that the student did not read the statements carefully or perhaps felt generally apathetic towards the lesson.

Table 5.1.5b gives the means and standard deviations of these Likert scale responses to the statements in this survey. All 17 students (11 females and 6 males) in the group responded to the survey.

Statement	Mean	Population SD	Sample SD
The website was easy to learn how to use and navigate	4.53	0.70	0.72
I felt I was able to learn from the website	4.47	0.70	0.72
The website was easy for the teacher to set up	4.35	0.84	0.86
I was on task while using the website	4.29	0.75	0.77
I liked interacting with the activities on the website	4.24	0.88	0.90
I felt motivated whilst using the website	4.24	0.81	0.83
I found the website instructions clear	4.12	0.96	0.99
The graphics and animations from the website helped me to learn	3.76	1.26	1.30
Overall mean	4.25		

Table 5.1.5b: Year 10 Website Evaluation Survey Responses – Means and Standard Deviations (n = 17)

The Year 10 website, designed using Yola, received mainly positive responses from students, with an overall mean of 4.25. The least positive response was to the statement "*The graphics and animations from the website helped me to learn*" with a mean of 3.76 and a standard deviation of 1.30. This supports the evidence from the Year 9 and Year 10 groups suggesting that students desire a website to be colourful and animated e.g. "*better graphics*" (Student IDs: 125 and 126) although whether this helps them to learn or is a personal preference when choosing which sites to access is unclear. Two students specifically commented in the qualitative responses (see Table 5.1.5c) that the website would be easier to use if there were better graphics.

Table 5.1.5c displays the qualitative responses from the Website Evaluation Scale survey.

	Positive Comments	Negative Comments and Advice
Technology - features controlled by the Teacher	There were no technology based issues while using the website (14 students)	Make it fun and simple
	Use them more	The names of these websites are somewhat hard to remember (the name)
	All is there and it is easy to use already	A simpler layout would make it easier to use
	Use them more than Kerboodle because it's better and you don't have to remember a password and no-one would complain about "I can't remember my password" wasting half the lesson	It would be easier to use if there was more colour, and the links were clearer
		It would be easier to use if it was easier to access the games
		It would be easier to use if there were headings and titles
Technology – features not controlled by the Teacher		It would be easier to use if there were better graphics (2 students)
Teaching and Literacy		It would be useful for the teachers to talk through one of the activities (2 students)
		Give us more information
		Explain what to do/give clear instructions (4 students)
Learning and Engagement	Easy to learn from	It would be easier to use if you could ask for hints in questions
	It will help students to learn the periodic table and will help them a lot to understand chemistry and physics	
	It was quite easy to use and very helpful.	
	It helped me with my revision because it had a lot of quizzes and taught me a lot	
	They're fun to use, makes more people on task	
Personal and Social	I think they were good and interesting and it was fun to get out of the classroom	
	It's great	

Table 5.1.5c: Analysis of written responses for Year 10 Website Evaluation (n = 17)

The most common qualitative responses concerned clarity of instructions (4 students) although, fortunately, most students (14 of 17) reported that there were no technology based problems when using this website. One student even preferred the Year 10 website to Kerboodle, stating in the qualitative responses:

> "*Use them more than Kerboodle because it's better and you don't have to remember a password and no-one would complain about "I can't remember my password" wasting half the lesson."* (Student ID: 120)

This is a problem generated by using commercial webtools and was an issue also raised by the 10Y3 class. However, not needing a password to log in to the site does mean that the teacher is not able to track which students access the site or set individual homework tasks. There are clearly advantages and disadvantages to using commercial sites such as Kerboodle which must be weighed against those of the teacher-generated sites when deciding which to use in the classroom.

The two most positive statements were that the website was easy to learn how to use and navigate (mean = 4.53, SD = 0.72) and the students felt that they were able to learn from the website (mean = 4.47, SD = 0.72) but despite this, four students commented that teachers need to explain what to do or give clear instructions and two students requested that the teacher talk through one of the activities. It is possible that these students were trying to provide advice for other teachers rather than saying that the instructions were unclear in this lesson. All the students who made these comments were female, although this may not be significant as most of the group were also female.

5.1.6 KS5 Webtools Evaluation

This section details the responses to the KS5 Perceptions of Webtools survey which was completed by Focus Group D. The survey can be viewed in Appendix 2. As this was a longer survey, the tables in this section are broken down into their individual webtools.

- 5.1.6a: Blogs
- 5.1.6b: Wikis
- 5.1.6c: Course Websites
- 5.1.6d: Making Yola Websites
- 5.1.6e: Webtools

5.1.6a Blogs

Table 5.1.6a shows the means and standard deviations of the students' responses to the questions concerning blogs. Colour coding is the same as in the tables presented earlier.

Statement	Mean	Population SD	Sample SD
The blog environment is user-friendly	4.33	0.47	0.52
Blogs are useful for communicating with peers	4.00	1.00	1.10
Writing blog entries helps me to reflect on my work	3.67	0.94	1.03
I respond to posts on my own blog regularly	3.50	1.38	1.52
I like expressing my professional opinion in blogs	3.50	0.76	0.84
I expect other people to post comments on my blog	3.50	0.96	1.05
Blogs are useful for communicating with teachers	3.50	1.12	1.22
The process of writing feedback to peers is meaningful	3.33	1.11	1.21
I like expressing my personal opinion in blogs	3.33	0.75	0.82
I access others' blogs regularly	3.33	1.11	1.21
I access my own blog regularly	3.33	1.25	1.37
Writing blog entries helps me to reflect on my personal life	3.33	0.75	0.82
Overall mean	3.55		

Table 5.1.6a: KS5 Students' Perceptions of Blogs – Means and Standard Deviations (n = 6)

Only 6 students from the KS5 group elected to answer the questions about blogging; 5 females and one male. Caution must be exercised when drawing conclusions from this small number of responses as the researcher suggests that it may have been only those students who participated in blogging who elected to answer this section. These students indicated that they felt fairly positively about blogs. The most positive statement with a mean of 4.33 was that the blog environment is user friendly. This statement also had the lowest standard deviation, suggesting that students were in good agreement about this statement. However, students clearly did not all access their own blogs regularly (SD = 1.37) or respond to posts on their own blogs regularly (SD = 1.52). This contradicts Benkler's view of the immediacy of the blog environment (Benkler, 2006, p.217) and suggests that many of the KS5 group did not blog at all and of those that do, use was sporadic. This may indicate that blogging is a personalised activity, with some finding it useful for communicating with others, either through meaningful comments or sharing jokes, and others using it as more of an online diary. The questions about blogs were included, despite not being specifically investigated, as a comparison to other webtools studied.

5.1.6b Wikis

Table 5.1.6b shows the means and standard deviations of the students' responses to the questions concerning wikis. All the students had participated in the writing of a wiki in their Chemistry lessons with the researcher, so a larger number of students (14) answered this section of the survey.

Statement	Mean	Population SD	Sample SD
It was easy to use the wiki after being shown how to use it	4.57	0.62	0.65
I was comfortable with the degree of publicity of the wiki	4.36	0.61	0.63
There were no technology based issues with the wiki	4.07	0.88	0.92
It was easy to use the wiki initially	4.00	0.85	0.88
I felt that others will learn by using the wiki	3.93	0.70	0.73
It was effective to use the wiki in group work	3.79	0.77	0.80
I felt that I learned something by using the Wiki	3.64	0.81	0.84
The wiki was effective in supporting learning	3.43	0.82	0.85
The wiki helped in producing good quality work	3.29	0.80	0.83
The wiki was effective in supporting engagement with course content	3.29	0.80	0.83
The wiki made collaboration with others easier	3.29	0.84	0.88
I liked commenting on others' work	3.21	0.77	0.80
I liked editing others' work	3.21	0.77	0.80
I liked that others could comment on my work	3.14	0.83	0.86
The wiki motivated me to collaborate with others in the group	3.14	0.83	0.86
The text editor on the wiki was easier to use than MS Word	3.00	0.85	0.88
The text editor on the wiki was more enjoyable to use than MS Word	3.00	0.53	0.55
The quality of collaboration in the group increased with the use of the wiki	3.00	0.85	0.88
I liked that others could edit my work	2.93	0.95	0.99
I would have preferred the wiki to be less public	2.50	0.50	0.52
Overall mean	3.44		

Table 5.1.6b: KS5 Students' Perceptions of Wikis – Means and Standard Deviations (n = 14)

The KS5 group's perceptions of the wiki were generally positive. The most positively rated comments included "*It was easy to use the wiki after being shown how to use it*" (mean = 4.57, SD = 0.65) and "*There were no technology based issues with the wiki*" (mean = 4.07, SD = 0.92). The statements gaining the most negative responses were "*I liked that others could edit my work*" (mean = 2.93, SD = 0.99) and "*I would have preferred the wiki to be less public*" (mean = 2.50, SD = 0.52). The last statement was included as a way of checking the robustness of the survey, as the opposite of the statement "*I was comfortable with the degree of publicity of the wiki*", which produced a mean of 4.36 and a standard deviation of 0.63. Therefore students seemed to be happy with the wiki being in the public domain to view but only users to edit.

It is worth noting that the students were fairly evenly split on whether they liked their work able to be edited by others. It is possible that the students felt that it is too easy for others to delete their hard work on a wiki, and teachers may need to consider how to ensure this does not occur in their lessons; for example, each student could have their own page. However, it is perhaps unfortunate that students felt this way given the potential benefits to learning of correcting others' work. It is also noteworthy that throughout the study, the researcher received no questions or comments from this focus group with regards to their e-safety, which may either indicate that the students trusted that the teacher had considered this before setting up the wiki, or suggest that they were unconcerned with their work being in (potentially) the public domain. This may have been due to the fact that this group used pseudonyms (handles) when writing content on the wiki. As this site was to be made available to view, but not edit by the general public, this measure was suggested by the teacher to overcome the e-safety issue of students being identified.

5.1.6c Course Websites

Table 5.1.6c shows the means and standard deviations of the students' responses to the questions concerning course websites. All the students had the opportunity to use the Chemistry website in their Chemistry lessons and at home as the website was in the public domain, so all the students in Focus Group D (16) answered this section of the survey.

Statement	Mean	Population SD	Sample SD
I downloaded past papers from the course website	4.81	0.39	0.40
I downloaded markschemes from the course website	4.81	0.39	0.40
I think that downloading past papers/markschemes will improve my grade	4.81	0.39	0.40
Overall I was satisfied with the course website	4.75	0.43	0.45
I found the course website to be a helpful resource	4.56	0.61	0.63
I found the online lecture notes to be a valuable resource	4.25	0.83	0.86
I believe that course websites enhance learning	4.19	0.63	0.66
The lecture notes were easy to print	4.19	0.73	0.75
I think that reading/using the lecture notes will improve my grade	4.13	0.78	0.81
I find taking tests online convenient	4.13	0.78	0.81
I regularly visited the links contained on the course website	4.13	0.99	1.02
The course website is a good place for the instructor to place	4.13	0.86	0.89
I was satisfied with the content available on the course website	4.06	0.70	0.72
I found the links contained on the course website to be valuable	4.00	0.94	0.97
I think that completing the online quizzes will improve my grade	3.94	0.83	0.85
I used the course website to help me to understand course information	3.81	1.01	1.05
I think that using the course website will improve my grade	3.81	0.88	0.91
I believe that course websites will play an important part in education in the future	3.81	1.01	1.05
I think that using the online scheme of work will improve my grade	3.75	0.83	0.86
I liked that I received an instant grade after taking an online quiz	3.69	0.68	0.70
I found the online specification to be a valuable resource	3.69	1.04	1.08
I found the online quizzes to be a valuable resource	3.63	0.93	0.96
The quiz worked during my visit	3.56	0.79	0.81
I regularly completed the online quizzes	3.50	1.12	1.15
I think that reading/using the online specification will improve my grade	3.50	0.87	0.89
I found the online scheme of work to be a valuable resource	3.50	0.79	0.82
I would prefer a paper copy of the handouts	3.50	1.06	1.10
I think the email system will improve my grade	3.50	1.06	1.10
I would like to see course websites added to all of my courses	3.44	1.17	1.21
The course website increased my interactions with the teacher	3.44	0.93	0.96
I regularly visited the online scheme of work	3.44	0.86	0.89
I received a reply within 24 hours	3.44	0.93	0.96
I regularly used the course website to answer my questions	3.31	1.21	1.25
The course website increased my interactions with the other students in the group	3.31	0.92	0.95
I regularly visited the online specification	3.31	0.98	1.01
I regularly checked my email inbox for messages from the teacher	3.00	1.12	1.15
The course website helped to create a sense of community	2.81	0.95	0.98
I emailed the teacher using the 24 hour reply system	2.81	1.13	1.17
I would like to be able to contribute to the course website	2.75	0.83	0.86
Course websites extend personal interactions	2.63	0.86	0.89
Overall mean	3.75		

Table 5.1.6c: KS5 Students' Perceptions of Course Websites – Means and Standard Deviations (n = 16)

The responses to the survey about the KS5 Chemistry course website were also of generally positive scoring with 14 of the 40 statements having a mean response of 4 or more and 35 of the 40 statements having a mean response of more than 3. The most positive statements concerned the downloading and use of past papers and mark schemes which is perhaps unsurprising amongst students approaching their examinations. The statements "*Overall I was satisfied with the course website*" (mean = 4.75, SD = 0.45) and "*I found the course website to be a helpful resource*" (mean = 4.56, SD = 0.63) were also strongly agreed with by students. However, students did not think that course websites extend personal interactions or create a sense of community and they did not wish to contribute to the website themselves (mean = 2.75, SD = 0.86).

In the small group interview, two students commented further on this:

> "*I think a course website should be mainly made by the teacher but should have a student section as you learn from someone your own age. It's more relatable*." (KH, male, 18)
>
> "*I agree. Course websites are best made by the teacher; however a student section of the website is useful as it allows student-to-student interactions, which has the benefit of sharing of concerns about aspects of the course with people in a similar position*." (MW, male, 18)

Large standard deviations in agreement were found for statements that concerned the use of online quizzes, the email reply system and whether the students wanted course websites for all their subjects (mean = 3.44, SD = 1.21). The largest split was for the statement "*I regularly used the course website to answer my questions*" (mean = 3.31, SD = 1.25) which possibly suggests that the class, as a whole, use multiple resources when looking for answers to their questions.

5.1.6d Making Yola Websites

Table 5.1.6d shows the means and standard deviations of the students' responses to the questions about making their own websites using Yola. All the students had participated in the making of their own website in their Chemistry lessons with the researcher, and all but one student (15) answered this section of the survey.

Statement	Mean	Population SD	Sample SD
I found adding pictures and diagrams to the website was easy to do	4.20	0.75	0.77
I added diagrams and/or pictures to my website	4.13	0.72	0.74
I think that online quizzes improve enjoyment of websites	3.93	0.93	0.96
I added links to my website	3.93	0.85	0.88
The instructions were easy to understand	3.87	0.96	0.99
I was satisfied with the tools available on the Yola website	3.87	0.81	0.83
I had no technical issues when making the website	3.80	0.54	0.56
I used the instructions to help me to understand how to make my website	3.73	0.93	0.96
I was satisfied with the other features I could add to my website	3.73	0.77	0.80
I think that making the revision website will improve my grade	3.67	0.87	0.90
I was comfortable with the level of publicity of my website	3.60	0.95	0.99
Overall I was satisfied with the website I made	3.53	0.72	0.74
I found making the website to be helpful for revision	3.53	0.81	0.83
I believe that revision websites will play an important part in education in the future	3.53	0.72	0.74
I think other students will find my website to be a valuable resource	3.53	0.72	0.74
I believe that revision websites enhance learning	3.40	0.80	0.83
The quiz or game software worked and was easy to use	3.40	0.80	0.83
I added online quizzes or games to my website	3.33	1.07	1.11
I think that the ICT skills I used when making the website will be useful in the future	3.27	0.68	0.70
I think that completing my online quizzes will improve others' learning	3.27	0.77	0.80
The revision website exercise helped to create a sense of community	3.20	0.91	0.94
I learnt new ICT skills when making the website	3.00	0.73	0.76
I would like to make websites for all of my subjects	3.00	0.97	1.00
I regularly visited my website throughout the course	2.87	0.81	0.83
The revision website increased my interactions with the other students in the group	2.80	0.93	0.96
I regularly updated my website throughout the course	2.73	0.85	0.88
I would have rather completed a different activity in the class time spent making the websites	2.60	1.08	1.12
I found adding music to the website was easy to do	2.60	0.71	0.74
I added music to my website	2.53	0.88	0.92
I think that making the website wasted my time	2.00	0.63	0.65
I think making the website was detrimental to my learning	1.67	0.60	0.62
Overall mean	3.30		

Table 5.1.6d: KS5 Students' Perceptions of Making Websites – Means and Standard Deviations (n = 15)

Making their own websites was the main activity attempted with the KS5 class. Students felt positively about making the websites, indeed the lowest means were given for the statements "*I think that making the website wasted my time*" (mean = 2.00, SD = 0.65) and "*I think that making the website was detrimental to my learning*" (mean = 1.67, SD 0.62), suggesting that even if the students did not think that making the website helped them to learn, at least it did not harm their learning! Students, on average, agreed that making the website would improve their grade and that making the website was helpful for revision purposes. The researcher postulates that the skill of making a website may be useful to KS5 students later on in life; for example, businesses and University courses may increasingly utilise this skill so it may be a helpful learning tool for these students to practise now.

The main issues indicated here are that students did not regularly or consistently visit their website throughout their courses. This may have been due to the static nature of the sites they made. Some students included a comments section on their website. It would be interesting to see if there is a link between the interactivity of the website the student made and the frequency of access. However, one student provided a reason for their lack of accessing their website, stating, in the qualitative comments: "*I did not have time to update the website throughout the year*". (Student ID: 178)

The largest standard deviation in response was for the statement "*I would have rather completed a different activity in the class time spent making the websites*" (mean = 2.60, SD 1.12) indicating that some students found the task more beneficial than others. This is possibly due to their different learning styles, ICT literacy or preference for paper-based activities, however the researcher found this unsurprising as students are likely to have a personal preference for the type of activity completed in a lesson. With regards to how the students used the class time allocated for making their own website, 8 students responded that they would have rather made the website, 4 students responded neutrally and only 3 students would have preferred to complete a different activity, though none of these students felt that making the website wasted their time or was detrimental to their learning. Some students added online quizzes or games to their website, whilst others did not (SD = 1.11). This may have been due to time pressures or preferred learning styles. Students who like to complete quizzes may have been more inclined to also make them. The other statement with a high standard deviation was "*I would like to make websites for all my subjects*" (SD = 1.00) which suggests that the appeal of websites may be higher for some subjects than others.

5.1.6e Webtools

Table 5.1.6e summarises the means and standard deviations of the responses of Focus Group D to the general statements concerning webtools in the KS5 Perceptions of Webtools survey. All 16 students completed this section of the survey.

Statement	Mean	Population SD	Sample SD
Web tools allow learners and/or teachers to find and share educational resources.	4.38	0.70	0.72
Web tools develop skills needed in today's modern technological world.	4.31	0.98	1.01
Web tools provide collaborative learning opportunities.	4.25	0.83	0.86
Web tools allow learners to express individuality and creativity.	4.19	1.01	1.05
Web tools allow learners to pose questions to the community.	4.19	0.63	0.66
Web tools allow learners and/or teachers to share photos, music and videos.	4.19	0.73	0.75
Web tools allow learners to share their opinions, experiences and perspectives.	4.19	1.07	1.11
Web tools promote knowledge sharing.	4.13	1.05	1.09
Web tools appeal to digital native learners.	4.06	0.83	0.85
Web tools allow learners to become content producers and not just receivers.	4.06	0.90	0.93
Web tools help learners to develop communication and language skills	4.00	0.79	0.82
Web tools allow learners to work through their ideas and promote critical reflection.	4.00	0.79	0.82
Web tools facilitate communication and feedback between learners and teachers.	4.00	0.87	0.89
Web tools open classroom walls.	4.00	1.06	1.10
Web tools bring learners' work to an authentic and wider	3.94	0.83	0.85
Web tools promote learners to interact and build a learning community.	3.94	0.83	0.85
Web tools allow learners and/or teachers to hold forums to discuss topics of interest.	3.88	0.86	0.89
Web tools encourage learners to add value to the applications as they use it.	3.69	1.04	1.08
Web tools allow learners to connect content, people, ideas and conversations.	3.69	0.85	0.87
Web tools help learners to develop a sense of ownership.	3.56	1.00	1.03
Overall mean	4.03		

Table 5.1.6e: KS5 Students' Perceptions of Webtools – Means and Standard Deviations (n = 16)

The KS5 group perceived the webtools very positively, with an overall mean of 4.03. The least positively ranked statement was "*Web tools help learners to develop a sense of ownership*" (mean = 3.56, SD = 1.03) which raises the question of whether students are concerned that sharing their work using the webtools encourages plagiarism by others. The large standard deviation for the statement "*Web tools open classroom walls*" may have been due to a small group of students taking this statement literally, and should have perhaps been reworded. However, in the study by Yuen *et al.* (2011) this statement gave a mean of 4.2 and a standard deviation of 0.8 which suggests that the participants in their study did not experience ambiguity. Interestingly, both studies rated the statement "*Webtools develop skills needed in today's modern technological world*" highly with a mean of 4.3/4.31 (Yuen *et al*., 2011/this study) which highlights that students perceive that webtools can be used to help them learn.

Table 5.1.6f summarises the qualitative responses from the KS5 Perceptions of Webtools survey. 5 of the 16 students chose to write their own statements at the end of the survey and 11 students left these sections blank. 4 of the 5 students who commented were female. The responses were categorised as described earlier in this chapter.

	Positive Comments	Negative Comments and Advice
Technology – features controlled by the Teacher		The course website should be added to the school website so that everyone knows where it is.
Technology – features not controlled by the Teacher		The hyperlink and HTML text wouldn't always work but that was my fault as I hate HTML
Teaching and Literacy		Each person could be given a topic
Learning and Engagement	I found the Yola site very useful. I definitely think it has helped towards improving my grade. Going over past papers and having mark schemes so easily available helped me to practise and understand things I found tricky to start with. I found other peoples' sites helpful too - as they are other students, they make it clear and easy to understand.	I can see how Internet learning could be beneficial to some people but personally I prefer hard copies of revision material and in class learning.
Personal and Social		I did not have enough time to update the website throughout the year.

Table 5.1.6f: Analysis of written responses for KS5 Webtools Survey (n = 5)

Comments from the KS5 group were limited but those students who did comment gave detailed responses. One student said:

> "*I found the Yola site very useful. I definitely think it has helped towards improving my grade. Going over past papers and having mark schemes so easily available helped me to practise and understand things I found tricky to start with. I found other people's sites helpful too - as they are other students, they make it clear and easy to understand*." (Student ID: 174)

This comment supports the previous findings (Likert scale responses) that past papers and mark schemes are essential ingredients of a successful course website, but also states clearly that this student felt that both the teacher-made website and the websites made by other students helped her to improve her grade in Chemistry, which helps to answer the research question "What are secondary school students' perceptions of using Teacher generated course websites in science lessons?" as this student found them very useful.

5.1.7 Year 12 Bridging Project Evaluation

Prior to the 2012 summer holidays, every Year 11 student at the school who thought that they may study AS Biology, Chemistry and/or Physics was informed of the project. They were told that although it was a voluntary project, it was advisable for them to complete one for the subjects they may be taking in Year 12. They were given a slip of paper detailing the project outcomes and the website address on which the project could be found. The students then completed their projects over the holiday. E-mail support was offered by one Chemistry teacher and some students took advantage of this offer by asking for occasional support. The students were e-mailed back within 24 hours. After the holiday the students handed in any projects for marking and all the Year 12 AS Chemistry students (19 students) were then asked to complete the survey in Appendix 2. These students formed Focus Group E. The survey occurred during a Chemistry lesson during September 2012. 15 out of 19 students said they were informed of the project. 4 said they were not informed due to repeating year 12 (though they did not know this at the time), thinking that they were not going to stay on into sixth form or thinking that they were not going to study a science subject. 11 students completed at least one project and one student did all three.

Table 5.1.6a summarises the Likert scale responses to the first part of the Bridging Project Evaluation Survey, concerning the students' opinions of the project (for the 11 of 19 students who completed a project). The Likert Scale used in Table 5.1.6a below was as follows: 1 = Strongly Disagree, 2 = Slightly Disagree, 3 = Neutral, 4 = Slightly Agree, 5 = Strongly Agree. The positive responses were highlighted green and the negative were highlighted orange.

ID	Age	The bridging projects were easy to access	The bridging projects were easy to download	The website was easy to use	I would have preferred a paper copy of the bridging project	I could get help with the bridging project when I needed it	I would have preferred using a forum so I could discuss answers with others	I enjoyed completing the bridging project	I found the bridging project interesting	I learnt new things by doing the bridging project	I refreshed my memory of my science subjects by doing the bridging project	Completing the bridging project has helped me have a good start to my AS courses	Completing the bridging project has improved my confidence in my subjects	I would recommend that other students complete a bridging project prior to starting their AS courses
192	16	4	4	4	5	3	2	3	3	5	4	4	4	5
193	17	4	5	5	3	4	3	5	5	4	4	3	4	4
194	16	5	5	5	3	3	2	4	4	4	4	4	4	5
195	16	3	4	4	3	2	3	3	3	5	4	4	3	4
196	16	5	5	5	5	4	5	3	3	4	5	3	3	4
197	16	5	3	5	1	5	3	3	4	5	5	4	3	5
198	16	5	5	5	1	4	3	3	4	5	5	5	4	5
199	16	5	5	5	5	2	3	4	5	5	5	5	5	5
200	17	5	5	4	3	4	3	4	4	5	4	4	4	5
201	16	3	4	5	5	4	3	2	4	4	3	2	3	3
202	16	5	5	5	4	4	1	4	4	5	5	5	5	5

Table 5.1.7a: Likert scale responses for Bridging Project Evaluation Survey (n = 11)

The statements "*The website was easy to use*" and "*I learnt new things by doing the bridging project*" elicited only positive responses from all the students. One student

(Student ID: 202) answered positively to all the statements except "*I would have preferred using a forum so I could discuss answers with others*" which suggests that this student was satisfied with all questioned aspects of the project as a forum was not included. 10 of the 11 students who completed the project said that they would recommend that other students complete a project prior to starting their AS courses, found the project easy to download and found that the project refreshed their memories. The means and standard deviations of the responses from Table 5.1.7a have been displayed in Table 5.1.7b. A mean of 3 would have indicated a neutral response from all participants. The colour coding was the same as for the tables earlier in this chapter.

Statement	Mean	Population SD	Sample SD
The website was easy to use	4.73	0.45	0.47
I learnt new things by doing the bridging project	4.64	0.48	0.50
The bridging projects were easy to download	4.55	0.66	0.69
I would recommend that other students complete a bridging project prior to starting their AS courses	4.55	0.66	0.69
The bridging projects were easy to access	4.45	0.78	0.82
I refreshed my memory of my science subjects by doing the bridging project	4.36	0.64	0.67
I found the bridging project interesting	3.91	0.67	0.70
Completing the bridging project has helped me have a good start to my AS courses	3.91	0.90	0.94
Completing the bridging project has improved my confidence in my subjects	3.82	0.72	0.75
I could get help with the bridging project when I needed it	3.55	0.89	0.93
I would have preferred a paper copy of the bridging project	3.45	1.44	1.51
I enjoyed completing the bridging project	3.45	0.78	0.82
I would have preferred using a forum so I could discuss answers with others	2.82	0.94	0.98
Overall mean	4.01		

Table 5.1.7b: KS5 Students' Bridging Project Survey Responses – Means and Standard Deviations (n = 11)

The overall mean of 4.01 indicated that this group generally felt positively about the bridging project. Students gave a negative response to the question "*I would have preferred using a forum so I could discuss answers with others*" (mean = 2.82), but all the other mean responses were positive. The students indicated that they enjoyed completing the bridging project (mean = 3.5) and found it interesting (mean = 3.91). They also said that completing the bridging project has improved their confidence in their subjects (mean = 3.82) and this helped them to have a good start in their AS courses (mean = 3.91) as it refreshed their memory of their science subjects (mean = 4.36). Happily, the students found that the website was easy to use (mean = 4.73) and that the bridging projects were easy to access and download, and they stated that they would recommend that other students complete a bridging project prior to starting their AS courses; these statements all having a mean response of around 4.5.

With regards to the research question: "Do secondary school students perceive that Web 2.0 tools and ICT based teaching tools contribute positively to their learning", perhaps the most important statement was "*I learnt new things by doing the bridging project*" to which the students responded positively, giving a mean of 4.64, which is encouraging, although does not directly indicate that the learning was due to the ICT tools used to deliver the project. It is also worth noting that the students did not generally feel a forum would be necessary, which indicates that the e-mail support, although not used by many, was adequate to meet their needs. Students generally found the projects interesting and some enjoyed completing them, however the students were evenly split over whether they wanted a paper copy of the project. The standard deviation of the response was 1.5 – the highest of all the responses. The researcher suggests that this may, have been dependent upon the age of the student (perhaps some students may be more used to submitting work online) and the nature of the task (perhaps some tasks are more easily completed with a pen and paper).

Through informal questioning of the group during one Chemistry lesson, the students indicated that they felt paper copies were unnecessary as they could be misplaced and could always be printed out if the original documents were available for download; however, some felt that paper copies were useful should there be no Internet access in a particular location, for example if the student were on holiday abroad, or if they only had a shared family computer. Only one female student commented on this (see Table 5.1.7c) in the survey, saying:

> "*Maybe put it on paper. It would have helped for me if it was multiple choice questions or easier to answer as I'm on holiday for the majority of the summer*." (Student ID: 192)

Table 5.1.7c categorises the qualitative comments made by the students in the Bridging Project Evaluation Survey.

	Positive Comments	Negative Comments and Advice
Technology – controlled by the Teacher		Maybe put it on paper. It would have helped for me if it was multiple choice questions or easier to answer as I'm on holiday for the majority of the summer.
		Outline the tasks in bullet points instead of the video – it was hard to understand
Technology – not controlled by the Teacher		Explain the task in a word document rather than the video as it was difficult to understand – repeatedly froze and jumped forwards.
Learning and Engagement	It was very useful and worthwhile.	It hasn't has an impact so far because we haven't covered the topics yet.
	Helped refresh me going into year 12	
	It has definitely given me a head start and got me in the mind set for A level studies	
	However it was useful and got me in the right frame of mind for AS.	Not sure so far. Although the bridging project was interesting I'm not sure of its relevance to the AS level. The worksheets were quite useful but I'm not sure about the part on greenhouse gases.
	It refreshed my memory of the elements and some equations	
	The bridging project was able to get me back into biology and chemistry after having had a very long summer of exam leave etc. I felt it helped me with some of the early AS work and recapping the higher level GCSE stuff; therefore I could start year 12 more confidently knowing I had a solid understanding from GCSE and a start on AS work.	
	The bridging project helped me to get a good start in my Biology and Chemistry AS levels. I found them both useful and interesting and I am pleased that I completed it because it has helped me more than I thought it would and refreshed my memory of what I had completed at GCSE. This meant that the first few weeks of school were not as challenging.	
	Gave me a head start on learning lots of key names of organelles and their functions.	
Teaching and Literacy	I think a project going into year 13 would be beneficial.	It could be improved by making it cover all relevant GCSE topics that will help us at AS level and then some of the topics covered early in your AS.
		I think it could've been made clear how much work was involved so I could've spread it over summer more.
		Explain them more to year 11s before they go away for the summer otherwise people will forget/not be interested. Maybe do a presentation lesson to year 11s interested in any of the AS sciences.
Personal and Social		It was interesting but not very relevant to AS.

Table 5.1.7c: Analysis of written responses for Year 12 Bridging Project Survey (n = 11)

In addition to these qualitative comments, 5 students who did not complete the project gave reasons for non-completion. Some students did not envisage taking a science subject, then changed their mind at the start of the new academic year; some students claimed that they did not know about the project, perhaps due to absence at the end of the previous term; some students forgot about the project or ran out of time due to work or holiday commitments and one student admitted it was due to their laziness!

It is clear that something can be done to increase the likelihood of students completing the project. For example, the project could be offered to more students, which may not increase the proportion of students undertaking the project, but it would give more confidence in the results. Also e-mail reminders could be sent or it could be publicised more frequently or more effectively. One student verbally commented to the teacher that maybe a presentation to Year 11 in assembly would help, whilst another wrote "*Do a presentation lesson to Year 11s interested in any of the AS sciences*". Students could also be told the project is compulsory and could be set one piece of work every week to ensure they do not run out of time. Students requested that it be made clear how much work was involved so the project can be spread over the summer more evenly. The projects could also be started at the end of Year 11 to encourage the students to complete them, although this may affect their examination revision.

The students who took part in the study gave some advice. One student said "*Maybe put it on paper*". Although this would defeat the objective of using webtools, a paper copy could be made available to students with limited access to the Internet, or who specifically request a paper copy. There was general ill-feeling about the animation, with students complaining that it skipped and was difficult to understand, and requesting the task be explained, using bullet points in a Word document instead. An interesting comment regarding how to improve the bridging project was "*Make it cover all relevant GCSE topics that will help students at AS level and some of the topics covered early in AS*". As the content was carefully selected by the teachers involved in order to meet this objective, the researcher found this comment significant and it is possible that the student who made the comment was not fully aware of the topics they would be studying at AS!

Another student made the comment "*It would have helped for me if it was multiple choice questions or easier to answer as I'm on holiday for the majority of the summer*." (Student ID: 192), which suggest a willingness to complete some work over the holiday, but also a lack of awareness of the demand of AS science studies. It is worthy of note that at the time of writing (2013) AS and A2 Edexcel Chemistry examinations did contain a multiple choice component, although this school followed the OCR specifications for all three sciences at KS5 which did not contain any multiple choice questions in their examinations.

5.1.8 Year 9 TDA Literacy Project

This project was a joint venture with two PGCE students and a local University in 2012. The purpose of this survey was to gauge Year 9 students' enjoyment and engagement of a lesson in which webtools were being used as a primary feature, with a view to understanding if webtools affected students' learning, engagement and enjoyment. The University lecturers were also interested in if the webtools improved students' literacy, although the lesson was not specifically designed with this in mind.

The data collection form (entitled Science Pupil Voice Survey: Evaluation of Lesson) was designed by the University's lecturers, which accounts for the difference in style from the researcher's Likert scale surveys, and was not able to be changed by the researcher as the project was part of a larger study conducted by the University. The responses were not able to be converted to numerical responses (and therefore means and standard deviations could not be calculated) as some of the categories the lecturers chose as possible responses overlapped with one another. For example, if a student enjoyed the lesson “a lot”, this could also be “more than usual” or “less than usual” (which were also possible responses) and similarly, students were able to answer other questions with “yes”, “a little” or “a lot” and it is unclear where “yes” would be placed on a scale of responses. This is a fault with the design of the questionnaire which was unavoidable by the researcher, but has been overcome by grouping together the positive responses when conducting the analysis. The Pupil Voice Survey that was given to this group of students can be viewed in Appendix 2.

Table 5.1.8.a summarises the survey responses of these 30 Year 9 students with regards to their perceptions of the lesson and if the webtools they used in the lesson (etherpads and a corkboard) improved or affected their learning, participation in the lesson, enjoyment of the tasks, and their literacy skills.

ID	Gender	I enjoyed the lesson…	Did the technology help you learn about the concepts related to the topic?	Did this lesson help you to improve your reading or writing skills?	Did the ICT in this lesson help you to understand the meaning of keywords?	I participated in this lesson…
83	M	more than usual	yes	about the same	yes	more than usual
84	M	about the same	yes	yes	a lot	less than usual
85	M	more than usual	a lot	yes	about the same	more than usual
86	F	more than usual	yes	no	about the same	more than usual
87	F	more than usual	yes	about the same	about the same	more than usual
88	F	more than usual	yes	about the same	yes	more than usual
89	M	more than usual	yes	about the same	about the same	about the same
90	M	more than usual	yes	about the same	yes	more than usual
91	M	about the same	a little	a little	a little	about the same
92	F	more than usual	about the same	about the same	a little	about the same
93	M	more than usual	a lot	a little	about the same	a lot
94	M	more than usual	yes	about the same	yes	about the same
95	M	a lot	yes	a little	about the same	about the same
96	F	less than usual	a little	about the same	about the same	about the same
97	M	about the same	about the same	about the same	about the same	about the same
98	F	a lot	a lot	not sure	no	a lot
99	F	more than usual	yes	about the same	yes	about the same
100	F	more than usual	yes	about the same	yes	more than usual
101	F	more than usual	yes	a little	yes	more than usual
102	F	more than usual	a lot	about the same	a lot	more than usual
103	F	more than usual	a little	not sure	not sure	more than usual
104	M	a lot		about the same	yes	
105	F	more than usual	yes	no	a little	more than usual
106	F	more than usual	yes			
107	F	a lot	a lot	a lot	yes	more than usual
108	F	more than usual	yes	no	a little	more than usual
109	M	more than usual	yes	a little	no	about the same
110	F	about the same	a lot	a little	yes	about the same
111	F	about the same	yes	not sure	not sure	more than usual
112	M	about the same	about the same	no	no	about the same

Table 5.1.8a: Year 9 Pupil Voice Survey categorical responses (n = 30)

Most students (23 of 30) enjoyed the lesson a lot or more than usual. Six found the enjoyment level the same as classroom based lessons and only one student enjoyed the lesson less than usual. This female student said that the lesson was “*much harder*”. No students said that they did not enjoy the lesson at all. Figure 5.1.8a shows what features of the lesson the students enjoyed most. Some students suggested more than one feature. The responses were categorised in order for the most popular types of comment to be visualised.

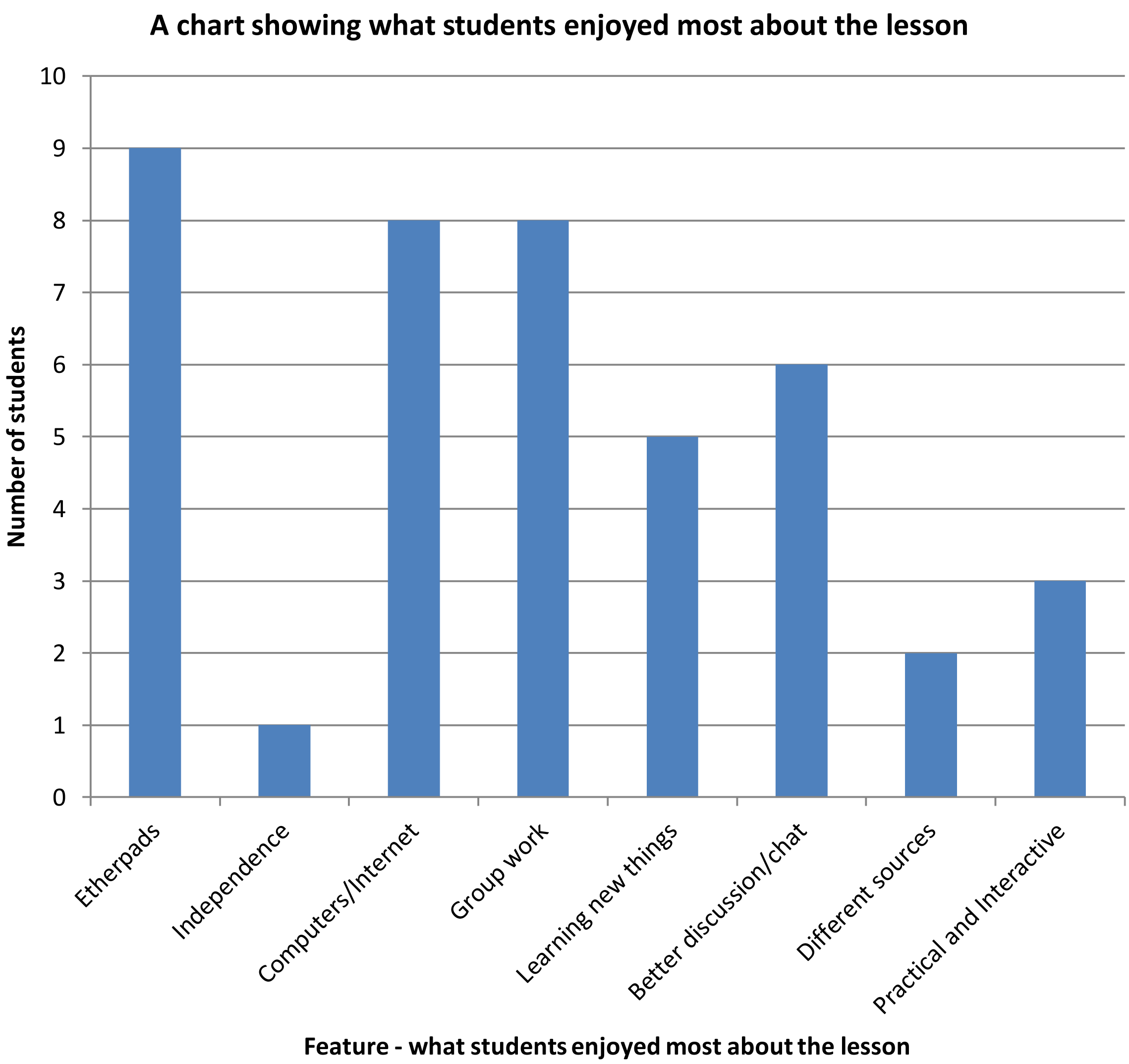

Figure 5.1.8a Student enjoyment of the lesson – features (n = 30)

The students said that they enjoyed using the etherpads the most, closely followed by using the computers or Internet in general and the fact that they were working in groups. Figure 5.1.8b shows the reasons that the students gave for enjoying the features of the lesson. Some students did not give a reason.

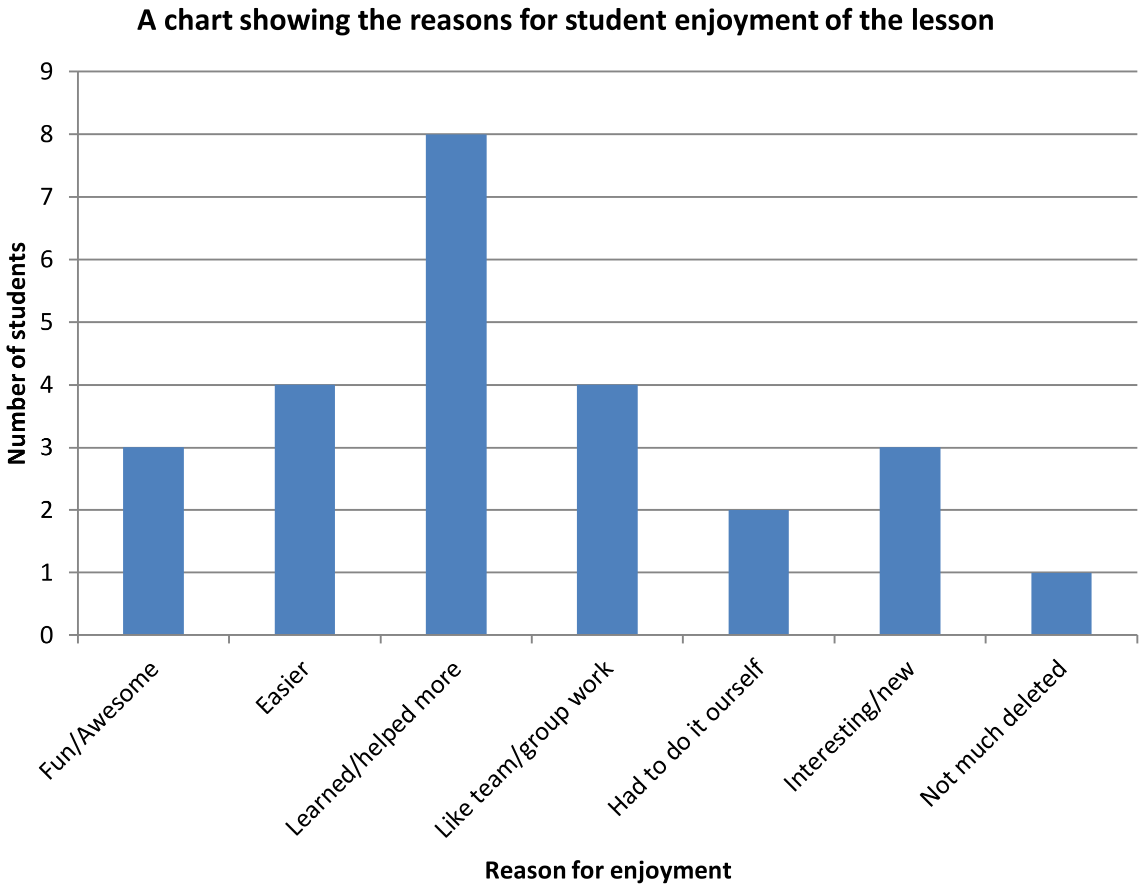

Figure 5.1.8b – Student enjoyment of the lesson – reasons (n = 30)

The researcher found it encouraing to note that the most common reason that the students gave for enjoying the lesson was that they learned more or it helped them more (8 students). Other common comments related to finding the features fun (3 students), interesting (3 students), easier (4 students) or that the lesson encouraged group work (4 students). When considering learning using the etherpads and corkboard, 23 out of the 30 students stated that the technology helped them to learn about the concepts, 6 of which said "*a lot*". This response is important as it relates directly to the research questions. 3 students thought that their learning was the same as usual and 3 students said the technology helped "*a little*". One student did not answer this question.

With regards to the literacy aspects of the lesson (Figure 5.1.8c), the most popular response to the question "*Did this lesson help you to improve your reading or writing skills?*" was "*About the same*", suggesting either that the technology had little effect on their literacy or that their science lessons improve their literacy well anyway. As only 4 students said that the technology did not improve their literacy skills and 3 were unsure, the majority felt positively about this aspect of the lesson.

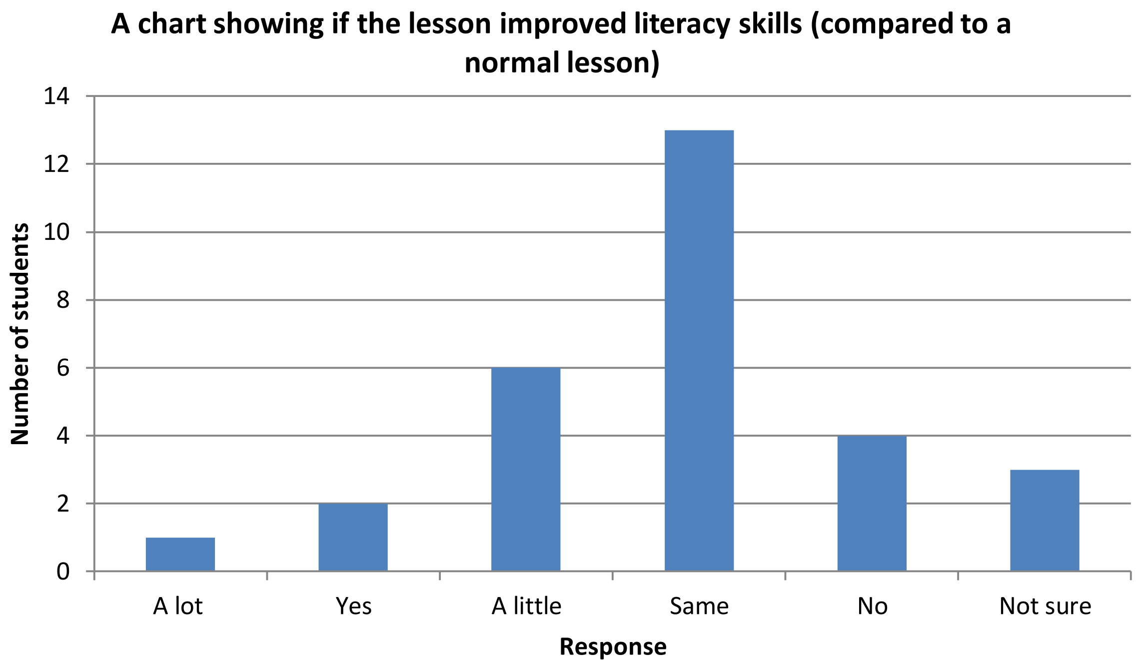

Figure 5.1.8c – Literacy skills (n = 30)

Figure 5.1.8d shows that the students also thought that the ICT helped them to understand the meaning of key words at least as well as usual, with only 5 students responding negtively or saying they were not sure. One student did not answer this question. The qualitative responses (Table 5.1.8b) indicated that being able to “Google” the unclear words was useful (3 students).

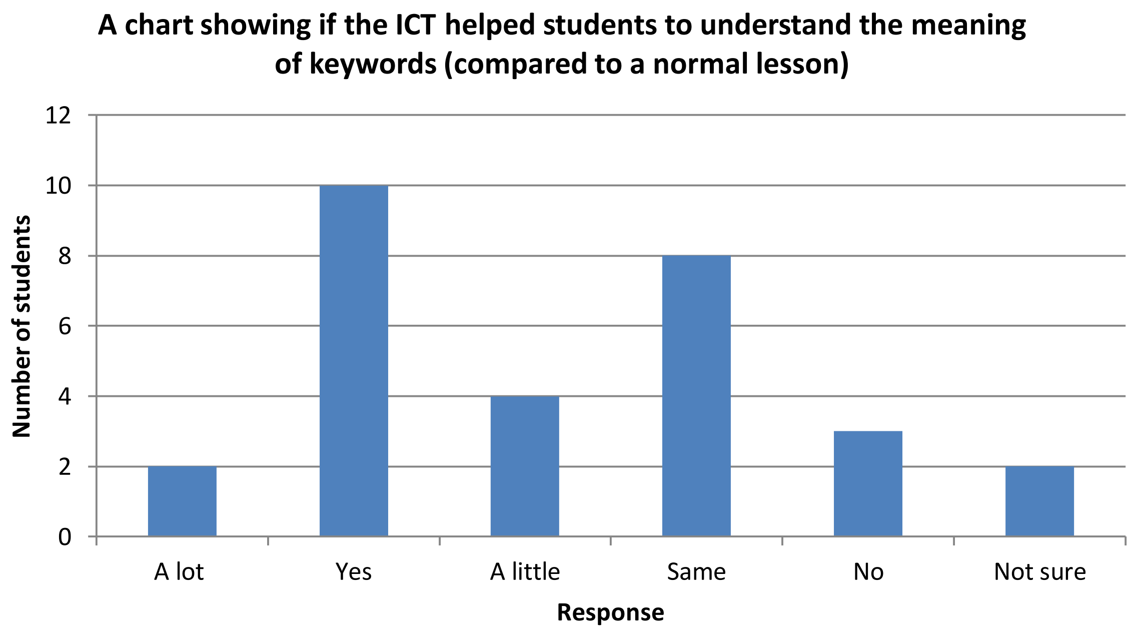

Figure 5.1.8d – Key word understanding (n = 30)

With regards to participation in the lesson, most students (16 of 30) thought that they participated more than usual and 11 students thought that they participated in the lesson about the same as usual. Only one student indicated that they *"…partcipated less than usual because it's much harder*." (Student ID: 84) This is a useful comment and may be contrary to the "*it is easier*" comments previously reported. However, like with most teaching activities, webtools may appeal to many but not all students, and comments such as this are perhaps to be expected.

Table 5.1.8b below maps the qualitative responses from the Year 9 Pupil Voice Survey, which can be seen in Appendix 2. Unlike the other qualitative tables displayed in this chapter, it was more appropriate to change the categories entitled "Technology – features controlled by the Teacher" and "Technology – features not controlled by the Teacher" to "Technology – concerning etherpads" and "Technology – concerning computers and the Internet" as when the written responses were analysed, the researcher thought that these were more logical categories on this occasion, as the questionnaire responses fell largely into these two new categories. There were also two comments which were not clearly positive or negative, so another "Neutral comments" column was added for this table.

	Positive Comments	Negative Comments	Neutral Comments
Technology - concerning etherpads	It's interactive	People deleted mine (only problem)	
	You could talk on chat		
	You can see the amount of work other people have done		
	On etherpad and corkboard you can contribute to your own answers		
	The etherpad helped me learn the subject		
	You can see other people's ideas / so you build up yours /learn too/correct each other (7 students)		
Technology - concerning computers /Internet	I liked working on the computers		It was IT related
	It's practical		
	There were more sources to read from/resources/information (6 students)		
	It was easier to find the information/we had the Internet (3 students)		
	It made it easier to understand		
	It had different sites linked to the Yola site to help us (2 students)		
Learning and Engagement	It's easier	I participated less than usual because it's much harder	
	As it was group work we had equal questions to do		
	I could always get my point of view across		
	It was more easier to answer		
	I was able to share my ideas with classmates		
	it was easier to understand and talk to my group		
	I answered some questions – I usually don't answer any questions		
	You can record information in groups then move on to make a flow chart using the information on your own		
	It's easier to ask for help and easier to use		
	The main iron ore is called haematite. I didn't know that before but I do now. This proves that I work better on technology.		
Teaching and Literacy	Keywords: I could Google them if I didn't know (3 students)		
	Literacy: I could find more information		
	It usually emphasises the words		
	It had definitions		
	It was more clear/easier to understand (2 students)		
	It described the word if you kept on reading		
	It explained it in detail		
Personal and Social	It was fun and educational		I worked with a friend
	It got me more involved in the work		
	It helped me a lot		
	It was really interesting knowing what other people knew		
	I would like to have these types of lessons more often.		
	I felt more comfortable contributing		
	It was fun		

Table 5.1.8b: Year 9 Pupil Voice Survey written responses (n = 30)

The etherpad proved a popular webtool eliciting a lot of positive comments from the Year 9 class. The students especially found that being able to see others' answers was useful (7 students), with some indicating that viewing the amount and content of others' work encouraged them to improve their own answers. One student commented: "*It was really interesting knowing what other people knew.*" (Student ID: 87)

However, one student commented that their work was deleted, which is an issue with using these types of webtool and may demotivate students unless the teacher has procedures in place for dealing with this problem. Regardless the same student said that this was the only problem and there were many comments about the fun and interesting nature of the task. The term "easier" was used many times in the qualitative comments, as can be seen in the table above. Encouragingly, the researcher also observed that the class visibly enjoyed the lesson and this was confirmed when one student wrote: "*I would like to have these types of lessons more often*." (Student ID: 102)

To conclude, most of the comments and responses to this survey were positive and showed that this group enjoyed using the etherpads and corkboard, and felt that these improved their learning and engagement in the lesson. However, it is important to question why this was. It is possible that some students found that they could plagiarise others or complete less work than usual and still complete the main task. Some may have simply enjoyed that they could chat to other students without getting "caught" out of their seat. In further studies, it may be beneficial for researchers to restrict the chat function and examine if these tools still prove popular with students.

5.2 Summary

To conclude, in this section the findings were presented in the order depicted in Figure 5.1.1a. Focus Groups A (Year 9), B (Year 10) and D (KS5) said that they had a broad ICT skill base, despite rating themselves as largely intermediate level ICT users. On average, these groups had a slightly negative initial perception of webtools, with the exception of social networking, and most contributed very little to webtools at the start of the study, again apart from posting to social networking sites and using social video tools. Most students owned and had used many pieces of ICT based hardware such as a Smartphone although few owned or had used a PDA. Students seemed keen to learn how to use most webtools despite their initial experiences, with the exception of virtual worlds.

The Wikispaces wiki was viewed positively by the Year 9 students in Focus Group A but they preferred the commercial site Kerboodle, which they all rated very highly. The Year 10, Y-band students from Focus Group C had a contrasting and mixed view of Kerboodle, which was largely due to a slow Internet connection and frustration due to not being able to log in successfully for one group. The Year 10, X-band students in Focus Group B viewed the teacher-made Year 10 website positively but indicated that graphics and animations were important for students' learning and must be taken into account when teachers design their own sites.

The KS5 group, Focus Group D, evaluated several webtools. Their perceptions of webtools by the end of the study were very positive. Few kept a blog but those who did viewed them positively. Wikis were viewed positively, with the average response indicating that students felt that they learned from using them, although some disliked that other students could edit their work. The teacher-made Chemistry course website was viewed very positively with students generally feeling that it helped them to learn and would improve their grade, though they had little desire to contribute to the website themselves. This group also made their own website and generally thought that this activity would enhance their learning or improve their grade. Again, this group highlighted the importance of adding pictures and diagrams to a website with most students doing this and finding it easy to do.

The GCSE to AS transition students in Focus Group E rated the bridging project positively, saying that the website was easy to use and they learnt new things, but not requiring a forum to discuss their answers with others. Focus Group A thought that the etherpads and corkboards that they used in the TDA project lessons helped them to learn. They also said that they enjoyed the lesson and that they participated more in the lesson than normal lessons. These major findings are discussed in the next chapter.

CHAPTER SIX

DISCUSSION OF THE FINDINGS

6.1 Introduction

In this chapter the findings are discussed in detail. Firstly, the major findings are stated and explained and the importance and significance of these findings is discussed. The results are then compared to those of similar studies, where these exist. Finally, alternative explanations of the results are then considered and debated. The structure of this chapter is summarised in figure 6.1:

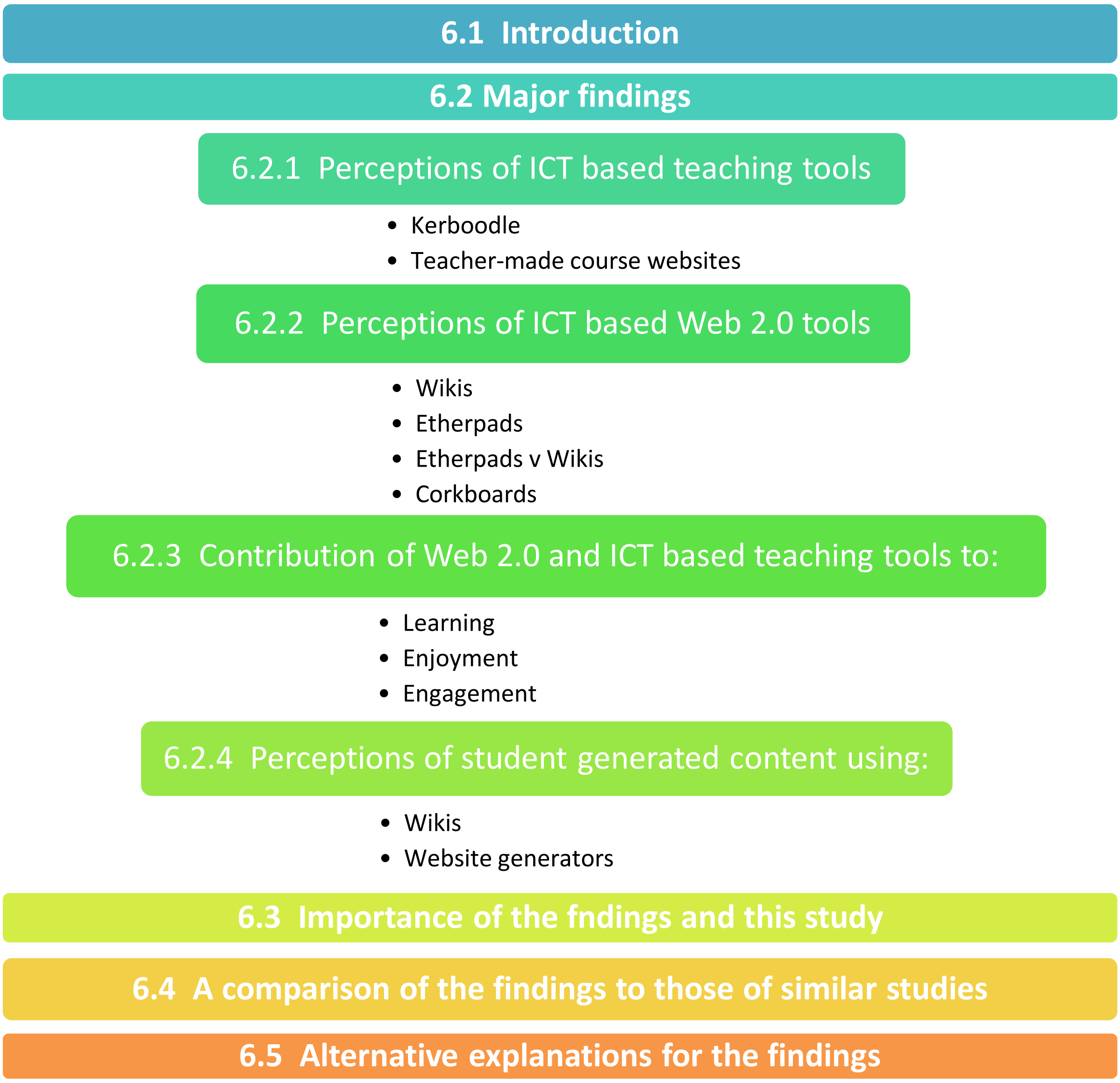

Figure 6.1: Outline of the Discussion of the Findings chapter

This study posed the following research questions:

1. What are secondary school students' perceptions of using the following ICT based teaching tools:
    a. Commercial sites e.g. Kerboodle
    b. Teacher generated course websites, in science lessons?
2. What are secondary school students' perceptions of using the following ICT based Web 2.0 tools:
    a. Wikis
    b. Etherpads
    c. Corkboards, in science lessons?
3. Do secondary school students perceive that Web 2.0 tools and ICT based teaching tools contribute positively to their:
    a. Learning
    b. Enjoyment
    c. Engagement, in science lessons?
4. Do Key Stage 5 students perceive that generating their own science content using:
    a. Wikis
    b. Website generators, improves their learning?

At the start of the project, the following findings were hypothesised:

1. Students will report that they perceive that both commercial sites, like Kerboodle, and teacher-generated course websites have a positive impact on their learning.
2. Students will perceive that Web 2.0 tools such as wikis, etherpads and corkboards help them to learn in their science lessons.
3. Secondary school students will say that Web 2.0 tools and ICT based teaching tools have contributed positively to their learning, enjoyment and engagement in their science lessons during this study.
4. Key Stage 5 students will perceive that generating their own science content using wikis and website generators improves their learning.

In section 6.2 below, the major findings are presented and compared to the hypotheses above.

6.2 Major findings

6.2.1 Commercial sites and teacher-generated course websites

The results of this study showed that most of the secondary school students in Years 9 and 10, surveyed in this study, perceived that both Kerboodle (41 of 54 students) and the teacher-made course websites (15 of 17 students) had a positive impact on their learning. The first hypothesis is supported by the following results, which have been separated into sections concerning Kerboodle and Yola websites for clarity and specificity.

Kerboodle

Focus Group A viewed Kerboodle positively with 26 of the 27 respondents to the Year 9 Kerboodle Evaluation survey (see Appendix 2 and tables 5.2.3a and 5.2.3b) saying that they felt they were able to learn from Kerboodle (mean = 4.74, SD = 0.53). The mean of over 4 indicated a high proportion of students agreed strongly with the statement and the relatively low standard deviation meant that there was only a small variation in responses. The students mostly found Kerboodle easy to use and felt motivated (mean = 4.44, SD = 0.58) when using the website, with one student commenting: "*I find it more interesting and it keeps me more on task*." Whether this was compared to other sites or non-ICT-based lessons, however, remains unclear, although the researcher recalled that the class appeared to be on task throughout the lesson and appeared to enjoy the activities, which supports this statement.

Another participant stated: "*It helps us focus more, we learn more*." Although a reason for this not was indicated, this participant directly linked their increased learning with being more focused; suggesting that students may feel that they are learning more if the webtool encourages them to stay on-task. This group responded positively to the statement "*I was on task while using Kerboodle*" (mean = 4.33, SD = 0.62) which supports this view. One student wrote a long comment, indicating that they felt that Kerboodle should be used more often, including in normal classroom lessons and that it should be used to set students' homework. They concluded: "*I really enjoyed this lesson and the website and will carry on using it at home as well in the future!*" The researcher thought that this was an encouraging response as this participant actually stated the desire to complete work using Kerboodle in their own time.

Other qualitative comments provided some insight as to why Kerboodle had been so popular with this Year 9 group. Some students liked the features such as the Kerboodle e-textbooks, especially being able to draw on them and highlight important sections, although others suggested improvements such as being able to write in text boxes or having an easier to use pen tool. One student preferred these to paper textbooks as they thought that their learning was more ‘free’. The word ‘fun’ also appeared in many comments, which indicates that this may be important when engaging this age group in science revision activities. Chou and Chen (2008) also found that motivation and the perception of an activity as ‘fun’ were linked in comments in their study, with one student commenting:

> “*For me, this is the first time using wiki page. It is fun! Compared to traditional teaching, it really motivates me to learn course materials*.”

This suggests that it may be worth teachers considering incorporating fun activities into their revision strategies.

In terms of the robustness of the site, 22 of the 27 students surveyed said that they had no technology-based issues when using Kerboodle, although one said that the videos did not work. This is a problem which is out of both Kerboodle and the teacher’s control and must be taken into consideration when using commercial sites – an external website is only as reliable as the school’s Internet connection or the computer speed. Regardless, this group both indicated in their numerical data (mean = 4.52, SD = 0.70) and written responses (5 students) that they found Kerboodle easy to use and one student stated that they enjoyed how all the topics were easy to access. However, not all students agreed, as one thought that “*how to get to places needs to be clearer*” and others suggested that clearer instructions or tutorials for doing this would be helpful. Irrespective of these few comments, most found the Kerboodle instructions clear (mean = 4.59, SD = 0.69).

In contrast with Focus Group A, Focus Group C viewed Kerboodle a lot less positively. The mean results for each statement were much lower for this group and the standard deviations were much larger. This may be mainly because in one of the three lessons the students experienced significant ICT issues, for example being unable to log in and the website not loading. Even so, more students had a neutral or negative response for at least one of the statements, in this group. On this occasion, 15 of the 27 students surveyed felt that they were able to learn from Kerboodle, all of whom were from 10Y1 or

10Y2 classes, indicating that no students in the affected 10Y3 class thought that they had learned from the website. It is worth noting that 10Y3 was the lowest achieving group so this may have contributed to their difficulties. Some staff in Crook *et al.*'s study (2008) agreed with this finding, also reporting that their classroom computers were too slow to run processor- and memory-hungry resources such as simulations and games which hampered learning in ICT based lessons.

Additionally, enjoyment and engagement were lower with this group as only 14 of the 27 students said they were on task (mean = 3.22, SD = 1.22) and only 7 said they felt motivated whilst using Kerboodle (mean = 2.56, SD = 1.22). This was despite 9 students commenting that there were no technology-based issues in their lesson, indicating that there may have been other reasons why this group felt less positively towards Kerboodle.

Many of the written comments indicated that students "*got lost*" when navigating through the activities and some gave advice as to how this could be corrected. The researcher suggests that clarity is essential when asking students to complete any task and website based activities are no exception. It is perhaps easy to assume that "*digital natives*" (Prensky, 2001, p.1) require less support with ICT but this may not be the case; in fact, students may require a deeper explanation as the commercial website concerned may function differently to websites that they have used before, making it more confusing initially. Williams and Chinn (2009) concur, stating that new webtools should build on students' existing experiences so students then become "*more creative and innovative in their exploration and adoption of available tools*" (p.172). This may be more difficult if a commercial site is used as the teacher has less control over its features. This was significant in this research as an overwhelming number of negative comments concerned navigation features that could not be controlled by the teacher, for example: "*It would be easier to use if the worksheets and different activities were in different categories*".

Other comments suggested that students found some of the activities too difficult and would have preferred more games or easier interactive activities. The researcher found it surprising that none of Focus Group A commented that the activities were too difficult; in fact, many said that they found them easy, despite Focus Group A being younger and having been taught less of the GCSE specification than Focus Group C. One Year 10 student commented: *"Prepare the lesson well beforehand or give the students complete freedom"* which may have indicated that they found Kerboodle restrictive, or felt that the teacher had not sufficiently differentiated the lesson to meet their needs. It is possible that the teacher underestimated how much planning a Kerboodle-based lesson required. Childs *et al.* (2007) experienced a similar problem in their study as: "*…some of our trainees also felt that once you had chosen a site your lesson was planned!*" (p.92), indicating that this may be a common theme with Internet-based lessons.

It is possible that other factors such as the time of the day the revision lessons were conducted or how well the researcher explained the tasks had a large influence on this group's perceptions of Kerboodle, although one student did give some encouragement in the qualitative comments, stating: "*Carry on as normal; you're doing a great job*." However, this type of comment may indicate a degree of bias towards the teacher, and it is possible that the student would have made a different comment to an unfamiliar researcher, so should be taken with caution.

Teacher-made course websites

The majority of the participants surveyed in this study perceived that the teacher-generated course websites had a positive impact on their learning. Focus Group B rated the teacher-made Yola website (www.year10science.yolasite.com) highly. Of the 17 students in this class, 15 said that they felt that they were able to learn from the website (mean = 4.47, SD = 0.72). One student said that the site was "*easy to learn from*" and another said that it helped them with their revision because it had a lot of quizzes and taught them a lot. One participant thought that the site would help students to learn the periodic table and to understand chemistry and physics. The relatively small standard deviation compared to the standard deviations for some of the other statements indicates that most students in this group agreed that the site was beneficial for their learning.

15 of the 17 Focus Group B students also felt motivated during the lesson (mean = 4.24, SD = 0.81) and 14 felt that they were on task (mean = 4.29, SD = 0.77), which was also confirmed in the qualitative comments by one student who stated that course websites were "*fun to use, makes more people on task*." It is worth noting here that one student responded with "3" for all statements, which may suggest that they did not take the questionnaire seriously or perhaps rushed through the questions. It is, of course, possible that the student genuinely felt neutrally about the whole lesson or was undecided.

In addition, students in both Year 9 and Year 10 largely thought they were engaged while using both Kerboodle and the teacher-generated websites, a result which was also reported by Kay (2011), Kay and Knaack (2007), Kay *et al.* (2007, 2009) and others when using different Web Based Learning Tools (WBLTs). Kay (2011) also found that significant increases in student performance were observed when science-based WBLTs were used which may imply that students learn more when they are more engaged in the task, and Web 2.0 tools can facilitate this.

The positivity of Focus Group B towards the course website may have been due to the lack of technology-related issues, as 14 students commented that this was the case. One student expressly stated that, with regards to course websites: "*Use them more than Kerboodle because it's better and you don't have to remember a password*", reasoning that nobody could complain about forgetting their password which would save time in the lesson. This implies that there would be more time in the lesson for learning activities when using a non-password protected website. Unfortunately this also means that individual student progress cannot be tracked (as is possible with most VLEs) and individual tasks cannot be set and handed in online (as is possible with Kerboodle). The educator must therefore either record progress in another way, potentially via online tests, or must allow for time to set up memorable usernames and passwords with the representative from the commercial site and know how to change students' passwords efficiently should the need arise.

This group indicated that when designing a website the teacher should consider the graphics and animations as they may, if designed correctly, help students to learn. 11 of the 17 students surveyed thought that the teacher had succeeded in this respect but two students disagreed. Qualitative comments were also made about the graphics of the website, with 2 students commenting that: "*It would be easier to use if there were better graphics*" and others requesting more colour, a simpler layout, clearer links, headings and titles. The researcher suggests that this group were primarily asking for help with navigating around the site, rather than more animations or complex graphics, as some also requested clearer instructions as well.

Unlike the qualitative comments made about Kerboodle, none of this group commented about wanting the site to have more videos, animations or games, perhaps because as the teacher had designed this site to meet this group's needs many interactive puzzles had been included, rather than a large volume of text-based worksheets reminiscent of Kerboodle. There is undoubted benefit to both types of resource but the researcher suggests that middle and lower set GCSE students are more likely to remain on task throughout a revision lesson of this sort (and therefore possibly learn more) when completing colourful animated puzzles and quizzes than they would when attempting a monochrome text-based worksheet of examination style questions.

Kay (2011) agrees that the design of the web based learning tool (WBLT) is important to students as in his study:

> "*Design was the highest rated feature of WBLTs. Students rated ease of use and visual features the highest. When selecting a WBLT, ease of use, quality of graphics, limited text and effective help are useful discriminating features to look for."* (p.370)

Focus Group D used the www.emschemistry.yolasite.com course website, which was also designed and made by the researcher using Yola. These KS5 students indicated that overall, they were satisfied with the website that the researcher had produced for them (mean = 4.75, SD = 0.45) and, to a lesser extent, they were satisfied with the content of the site (mean = 4.06, SD = 0.72). In the group interview, it was suggested that a welcome addition to the site would have been a student section where the class could share concerns and learn from one another. Reasons given for this were that students were able to learn from someone their own age, and that course websites allowed for student-to-student interactions, which has the benefit of concerns about aspects of the course being shared with students in a similar position.

The KS5 students also commented that they thought that the Webquests on the site were good and the site could be improved by the addition of a forum or RSS feed of "chemistry-related news". Most of this group believed that generally, course websites enhance learning (mean = 4.19, SD = 0.66) and that this particular site was a helpful resource (mean = 4.56, SD = 0.63) which would improve their grade (mean = 3.81, SD = 0.91). One student commented on this, specifically stating: "*I found the Yola site very useful. I definitely think it has helped towards improving my grade*."

Unlike the KS3 and KS4 groups, this KS5 group of students indicated that they desired test-based revision material such as past papers rather than quizzes. Students said that they downloaded past papers and markschemes (mean = 4.81, SD = 0.40) from the site, believing that they would improve their grade (mean = 4.81, SD = 0.40). They also felt that the online lecture notes were a valuable resource (mean = 4.25, SD = 0.86) and that reading them would improve their grade (mean = 4.13, SD = 0.81). The quizzes were less popular with fewer completing them (mean = 3.50, SD = 1.15) although students still thought that completing the quizzes would improve their grade (mean = 3.94, SD = 0.85).

Like the online quizzes, on average, the online specification and scheme of work were viewed to be a less valuable resource but as the standard deviation for these statements was larger; this implies that some students may have used them where others did not feel they would benefit from them. The researcher postulates here that interactive tasks and colourful animations become less important features of a good teacher-generated course website either as students mature, or perhaps as the level of the course increases.

6.2.2 Wikis, Etherpads and Corkboards

The results of this study show that most of the secondary school students surveyed perceived that Web 2.0 tools such as wikis, etherpads and corkboards help them to learn in their science lessons. This supports the second hypothesis.

Wikis

Focus Group A, on average, felt that they were able to learn from the Wikispaces wiki (mean 3.68, SD = 0.82); in fact, one student commented that "*Using websites is good because I learn more*" and another said that "I*t's a good opportunity and a good way of learning*." This may have been because they felt that the wiki was easy to learn how to use and navigate; this was the highest rated statement (mean = 4.29, SD = 0.71). However, the mean of 3.68 is lower than for the same question concerning Kerboodle (mean = 4.74, SD = 0.53) which indicates that this group thought that they were more able to learn from a commercial site on this occasion.

As well as being used for student generated content, Buzzetto-More (2008, p.115) found that course websites have proven to be an: "…*effective means of delivering learning materials with students responding positively to the quality resources they make available*" which suggests that a wiki could be used effectively as an interactive course website on which learning materials could be placed for students to access outside the classroom. This is similar to the intended use of the www.labbookonline.wikispaces.com wiki which was made by Focus Group D.

Although all the statements produced positive mean responses, fewer students in Focus Group A felt motivated and on task when using the wiki compared to when using Kerboodle. The main reasons given in the qualitative comments concerned the clarity of the site, ease of navigation and graphics. These technical aspects are clearly vital to this group as they indicated that an improvement in these areas would have made using the wiki easier. It is important, therefore, that educators carefully select which wiki to use with a class, and spend time making the navigation clear before showing it to students as they may form strong opinions of the technology early on in the learning process. Hughes' and Narayan's (2009) study agrees with this, stating that:

> *"…technical aspects of wiki technology may have a strong influence on the students' perceptions of the wiki for learning and collaboration."* (p.74)

Students from Focus Group C, in informal group interviews following their use of Wikispaces, indicated to the researcher that they felt positively about the wiki. They felt that they had learned well by recording podcasts and uploading them to the wiki and did not comment about these technical aspects. The researcher suggests that this was because the majority of the lesson was spent using familiar technology such as cameras and Dictaphones and uploading the audio and video files was similar to uploading to a social networking site. The students may have found this process simple so they were less inclined to comment on other technical aspects of the wiki.

Focus Group D, on average, also felt that they were able to learn from their wiki activity (mean = 3.64, SD = 0.84) with a surprisingly similar mean and standard deviation of response to Focus Group A. This KS5 group also felt that others would learn by using the wiki (mean = 3.93, SD = 0.73). They found the wiki easy to use both initially and after being shown how to use it and largely had no technology-based issues. The group were also happy with the degree of publicity of the wiki, indicating that they would not have preferred it to be less public. Although some students liked editing others' work (mean = 3.21, SD = 0.80), they mostly disliked having their own work edited (mean = 2.93, SD = 0.99). The willingness of the students to edit others' work is commented on in the literature, for example, Lund and Smørdal (2006) described an empowering wiki project, although they remarked how difficult it was for students to move towards willingly editing the text of their peers. Gadanadis *et al.* (2005, p.130) agreed and commented: *"It is* *interesting that in all three cases, there was some resistance to using the read/write features of a wiki."*

The literature suggests that this is not uncommon in initial uses of wikis (Grant, 2006). Similarly, in this study, Focus Group D viewed the collaborative nature of wikis fairly neutrally. Mean responses of 3.29, 3.14 and 3.00 were given for the statements "*The wiki made collaboration with others easier*", "*The wiki motivated me to collaborate with others in the group*" and "*The quality of the collaboration in the group increased with the use of the wiki*", respectively. Despite this, students still felt that they learned from using the wiki. This resonates with the findings of Hughes and Narayan (2009) who concluded that:

> *"While the theoretical and research literature posits that wiki technology supports collaborative learning...wiki use does not always have to be collaboratively enacted for it to be perceived as supportive of learning."* (p.74)

Students in Focus Group D agreed that their wiki was effective in supporting learning (mean = 3.43, SD = 0.85) despite fewer agreeing that this was due to collaboration. A positive aspect of the wiki task was that students became aware that they were writing for an unseen audience and this encouraged them to write more accurately and make their content more relevant. Thus it could be said that using the wiki improved their literacy (writing) skills. In this case, which is supported by the literature (Windsor, 2008; Wheeler *et al*., 2008), using the wiki was very effective in developing a resource made by students.

Wheeler *et al.* (op.cit.) advised that wikis should be used for collaboration rather than competition and suggested that it may be wise to practice collaborative editing in a smaller group before rolling it out to the whole class if there are some students who strongly disliked their work being edited, so that they had the opportunity to observe the benefits on a small scale. Workman, Jr (2008) agreed that students should be encouraged to use wikis for collaboration:

> *"Wikis in the classroom provide a unique opportunity for collaborative learning. While there are challenges in developing and hosting such projects, there are significant opportunities to deepen student engagement in the course material and for helping students appreciate a collaborative approach to learning."* (p.23)

More recently, An and Williams (2010) reported that use of Web 2.0 tools increased students' feeling of being members of a learning community by increasing interaction, communication, and collaboration. Half of the teachers in their study also said that the technologies assisted in the creation of environments where they could facilitate learning rather than distribute content.

Etherpads

The students who answered survey questions concerning etherpads enjoyed using them in their science lessons and thought that the technology they had used had helped them learn, which supports the second hypothesis. Focus Groups A and D had used etherpads in lessons, although no student from Focus Group D commented about the etherpads in the survey or group interview. One student from Focus Group A stated "*The etherpad helped me learn the subject*" and the most common element this group said that they enjoyed most about their webtools lesson was using the etherpads. 8 students said the reason why they enjoyed they lesson was because they learned more or the webtools helped them more and 23 of 30 students in this group said that the technology helped them to learn about the concepts related to the topic. This may have been due to the ease of access to information afforded by web technologies as several students made comments related to this.

Some students also commented that these webtools allowed students to view one another's answers, which enabled them to improve their own or correct others, whilst the nature of the technologies enabled them to "*always get their point of view across*". Teachers in a study by An and Williams (2010) found that Web 2.0 technologies were suitable for students without advanced technical skills because they were flexible and easy to use, and students subsequently improved both their literacy and technological ability through the use of these webtools. Most students in Focus Group A thought that the etherpads improved their literacy skills and their understanding of key words at least as much as in a normal lesson, which supports this finding.

Etherpads v Wikis

The volume of the qualitative comments concerning collaboration using etherpads is in stark contrast to the few made about collaboration with wikis. This may suggest that the students found etherpads to be a better collaborative tool than wikis and could be due to the fact that with etherpads, the collaboration occurs in real time. Students were able to write, edit and delete comments at the same time, and also use the chat function which may have given a better flow to the collaborative process. The researcher noted that although collaborative in nature, two students could not work on the same wiki page at once without one overwriting the work of the other, which some students found frustrating and perhaps hindered their learning.

Engstrom and Jewett (2005) agreed with this, commenting*:*

> *"Wikis do not allow multiple users to edit the same page at the same time. Thus those teachers who conformed to the traditional lab model discovered that some of their students were locked out of the page that they wanted to edit because a classmate had already begun editing that same page. Those teachers who arranged their students into small, cooperative groups of three to five students…expressed the most satisfaction with the wiki."*
> (p.15)

However, putting students into small groups may not suit the purpose of the lesson, especially if the teacher wishes all students to actively participate in generating content, in which case etherpads may prove more useful in this situation.

Corkboards

It is unclear from the results of this study whether a significant number of participants thought that the corkboard helped them learn in science lessons because few comments from students about the use of corkboards exist in this study. However, one participant from Focus Group D stated in the small group interview that: "*Also, the cork board was an excellent resource. I liked working in teams*" without being specifically asked about the corkboards they had trialled. This unprompted comment suggests that this student considered this tool had the potential to enhance the learning process.

No students from Focus Group A made any comments about the corkboard they used although it was clear to the researcher that there were clear issues with using the www.corkboard.me site. The researcher noticed that the Year 9 students moved and deleted others' posts, albeit sometimes accidentally. One study (Williams *et al., 2013)* found that rules for using corkboards must be established prior to use, because:

> *"The postings on Moodle discussion forums and the Wallwisher, compared with face-to-face comments, for example, required a different set of rules and expectations for sharing and collaboration to develop a taken-as-shared understanding." (*p.9)

Despite the first-time, exploratory use of corkboards in the researcher's study, 23 of 30 students contributed a Post-it and the contributors largely tried to show something they had learnt in the lesson. This can be viewed in Appendix 9. The researcher suggests that the corkboard was a good tool for demonstrating learning in this instance but other studies (Watson, 2012) found that corkboards may not meet all the needs of the participants, for example they may not facilitate discussion between students.

6.2.3 Learning, Enjoyment and Engagement

The results of this study showed that most of the secondary school students surveyed in this study perceived that that Web 2.0 tools and ICT based teaching tools they used contributed positively to their learning, enjoyment and engagement in their science lessons. This supports the third hypothesis.

23 of 30 students in Focus Group A said that they enjoyed their webtools lesson a lot or more than usual, one commenting that "*I would like to have these types of lessons more often*" and others commenting that it was "*fun*". 16 students thought that they participated in the lesson more than usual, which may be an indicator of increased engagement, suggested by the comment "*It got me more involved in the work*", although one student explained that it was because they "*felt more comfortable contributing*".

Following the Wikispaces task, Focus Group A felt that they were on task while using the wiki (mean = 4.18, SD = 0.77) which can be used as a measure to gauge engagement. To a lesser extent they felt motivated whilst using the wiki (mean = 3.79, SD = 0.92) which may be thought of as a more proactive measure. In the comments, one student remarked that "*Pupils are focused and concentrate more, knowing someone is watching it*." It appears that on average, the students enjoyed using the wiki, liked interacting with the activities (mean = 3.89, SD = 0.88) and they also felt that they were able to learn from the wiki, as previously stated. These findings are supported by the literature; for example Murphy and Lebans (2008), who found in their study that:

> "*As teachers who were interviewed integrated Web 2.0 tools into their courses and assessed their impact on student learning and achievement, they all confirmed what the research has already indicated: increased student engagement with subject content, greater responsibility of their own learning, deeper investigations of issues and improved student assignments."* (p.141)

Although only anecdotal evidence, students from Focus Group C, in informal group interviews, stated that they enjoyed using the wiki to store their podcasts, photos, storyboards and movies. They appeared, to the researcher, highly motivated and on-task when recording the podcasts (especially one mixed group in the class) and drawing the storyboards (especially one group of middle-ability girls). One middle-ability boy remained focused for the whole lesson whilst he drew and uploaded a Pixton cartoon strip to the wiki, enjoying this activity so much that he made another in his own time. The researcher suggests that there is scope for further investigation into the use of Pixton to engage students in science subject knowledge.

6.2.4 Student-generated content

The concept of students generating their own web content has been supported in the literature. As Fryer (2006, p.32) said: "Why focus on content transmission in the classroom when we can help students become content creators as well as consumers." The Key Stage 5 students involved in this study perceived that generating their own science content using wikis and website generators improved their learning (mean = 3.40, SD = 0.83) or that of their peers (mean = 3.27, SD = 0.80) and would improve their grade (mean = 3.67, SD = 0.90). This supports the fourth hypothesis. Fryer's study (op.cit.) supports this outcome and states:

> "*Students actually learn more when they construct their own knowledge and create products that reflect their understanding of ideas, processes and relationships. In addition to this, teachers know repetition can be a good thing when it comes to student learning and retention*." (p.30)

Focus Group D especially found that the website generation activity was good for revision (mean = 3.53, SD = 0.83) although the male students interviewed were more positive than the female students. One male felt that it was "*a novel way of revising*" because it enabled them to revise with a new tool, which was especially useful at home. Another male student found it useful as a method for rewriting notes, and therefore a good revision tool, and another student stated that it:

> "*…was helpful with my learning and revision of all the key topics in Chemistry. It also allowed me to be very versatile with what I could look through…and it inspired me to read deeper into the areas I was studying*."

He also thought that making the website built on his existing knowledge and improved his scientific literacy skills. This student appeared to fully embrace the website generation task set and appeared to benefit well from his enthusiasm. This attitude is supported by Richardson (2007) who advised that:

> "*We must be readers and writers, editors and publishers, to maximize the benefits of our participation; and we must be willing to collaborate and co-create with others, working closely together to learn even more in the process*." (p.150)

Another male student from Focus Group D agreed that working closely with others helped to improve his subject knowledge, explaining that this was: "…*because I felt I was teaching someone else, I felt I had to fully understand the content*."

The female students in the group had a slightly different perspective from the males, one thinking it was useful for revision, but the other commenting:

> "*I thought that making the website was sort of helpful, but not entirely. I found that writing the information helped me to understand the material better; however, I haven't looked at the website since*",

though she later agreed with the previous comment that a positive aspect was she had to understand the material well before posting it online.

The students mainly thought that the Yola site builder was easy to use, if time-consuming, though one thought it may have been too simple for skilled users. One student suggested that because it was easy, after some time adding content, the task became boring, whereas "*The wiki was hard to use at first but after using this software for a while it improved my ICT skills*." Another student disliked the wiki for writing up laboratories because "*It was complicated and not easy to access*."

6.3 Importance

The results of this study may be used to inform educators of the current situation concerning the adoption of Webtools in similar schools. The secondary school students involved in this study claimed to be able to complete a wide variety of ICT tasks, although they rated themselves as mainly intermediate users and had little experience of using Web 2.0 tools on a regular basis. Clark *et al.* (2009) explains this finding, stating that:

> "*While Web 2.0 type participatory technologies are a large part of young learners' everyday lives, very few learners are using these with a high level of sophistication…most learners would like to use at least some of these technologies to support their learning in more formal contexts."* (p.68)

Although students may not have used many Web 2.0 tools at school, it may still be argued that these students are 'digital natives'. In their study, Williams and Chinn (2009) found that:

> "*As digital natives (Prensky, 2001) the students already possessed technology skills that could be used as a platform. The assignment was then used to challenge the students to build on past experiences, explore new areas and develop new skills and understanding."* (p.172)

The findings of this study are important because they may influence the pedagogy and behaviour of the researcher, staff in the science department at the researcher's school, and potentially other teachers in the future. This study has shown that students enjoyed using Web 2.0 tools and believed that they learned by using them. By taking into account the past ICT experiences of the students, Web 2.0 tools may be used effectively to develop their skills, knowledge and understanding of key scientific concepts which are important both in and out of school. This concurs with Sendall *et al.* (2008) who stated:

> *"Overall, then it can be said that, yes, Web 2.0 matters. The skills are judged important both in class and in the workplace. Common gender neutral instruction can be effective in advancing the use of these important collaborative tools."(*p.13)

In most of the Focus Groups participation in the activities was good, with most students judging that they were on-task during the lessons involving webtools, thus this study has been important in showing that Web 2.0 tools may increase student engagement, a view which is supported by Merchant (2009, p.121) who concluded: *"It seems to me, then, that Web 2.0 technologies can promote participation and also that they can promote learning."*

This is in contrast to the fear of some educators may possibly have that students may not want to contribute to web based activities due to the permanence of the media. This concern may be especially prevalent when using etherpads, on which the content cannot be deleted and the time slider feature allows all revisions to be viewed. Crook *et al.* (2008) explained this potential concern, stating that:

> *"Material that is posted in Web 2.0 contexts has a way of haunting the poster. In contrast, thoughts that are spoken are transitory and thus potentially ignored or forgotten. They may also be reviewed and revised in the light of feedback. Even print on paper offers a better protection from embarrassment, for thoughts laid down this way may circulate far less widely."* (p.42)

However, students in this study did not report this fear, and thus these findings are important as they suggest that concerns raised by educators and other adults may not be mirrored by students. Indeed, students may not be concerned that thoughts and opinions they submit online may remain there for some time. This was demonstrated by the students in Focus Group D, who were largely unconcerned with the degree of publicity of their wiki and they did not want the wiki to be less public even though the wiki was made to be able to be viewed by any Internet user.

This study has also addressed the difference between commercial sites and teacher generated course websites on students' perceptions of their learning. Originally, the researcher's intention was to overcome the problem of her school not having a VLE. As described in this study, she made and trialled several course websites in order to gauge whether students felt that they could learn from them effectively. Alternatively, the researcher could have set up and trialled a free open-source VLE such as Moodle. One member of staff in Murphy and Lebans' study (2008) who had been using the open-source VLE Moodle discovered that:

> *"Moodle provided a major pedagogical advantage over a course web page in that it permitted much greater interactivity by making it possible for students to post and discus problems and solutions rather than simply access course information and resources."* (pp.140-141)

Therefore it may be assumed that if another Web 2.0 tool allowed students to do this, it could be used instead of a VLE. The researcher suggests that a wiki, such as PBWorks has this functionality and educators may wish to consider this use before developing a course website, as this study found that students viewed wikis positively. Other studies have agreed with this finding, for example in a study by Deters *et al*. (2010):

> "*Participants in this study reported that their overall experience with wikis was positive. Furthermore they thought that the wiki was a useful tool for online instruction."* (p.130)

6.4 Similar studies

A thorough review of the literature reveals few studies focusing on secondary school students generating their own Web 2.0 content in the UK. Courtois *et al.* (2009) explains this is possibly because:

> *"Research on the creation of online user-generated content is often conducted on American Internet users...Moreover, the scarce data on UGC in Europe is rather difficult to compare and interpret as measuring UGC is not straight forward... questions remain as to what extent adolescents adopt the practice of contributing content to the Web."* (p.113)

and concludes that it remains unclear whether students actively contribute or not. Sener (2007) explains that although Internet searches provide many references to student-generated content, these results yield few examples of student-generated content in educational contexts. Although the reason for this is unclear, Sener (op. cit.) suggests that:

> "*Terminology is an issue to some extent, which is no surprise to anyone who's had to deal with the absence of a common definition for terms such as distance education or online learning. "Student performance content", "learner-generated content" and "students as producers" are some of the other related terms currently in use."* (p.5)

The researcher experienced this problem when conducting her own review of the literature, especially considering this study focused on students generating their own websites. Websites, unsurprisingly, proved a rather popular search term! Sener (op.cit.) goes on to suggest that: *"The main reason it is difficult to find good examples, however, apparently is that there are relatively few examples to be found*." (p.5) It is, however, to be noted that this comment was made in 2007 and six years of research into student generated web content has undoubtedly been conducted since. In the same year, Lee and McLoughlin (2007) described several good examples of learner generated content in Higher Education in Australia but as of April 2013, no examples could be found in the literature of UK Secondary Science teachers using website builders with students to generate their own revision websites. Thus this is the original contribution to the knowledge that this study presents.

6.5 Alternative explanations

Alternative explanations of the findings may exist. It is possible that the researcher's perceptions of Web 2.0 tools influenced students' opinions. For example, if the researcher was knowledgeable about a particular tool, it is likely that the students would have benefited from her expertise, and therefore learned more when using this tool. Similarly, the groups may have found a webtool more fun and engaging if the researcher was enthusiastic about that tool. Other studies (Yuen *et al.*, 2011; Ajjan and Hartshorne, 2008; Crook *et al.*, 2008) support this view, with one commenting that: *"…teachers have high perceptions regarding the usefulness and applicability of Web 2.0 tools in teaching* *and learning…"* (Yuen *et al.,* 2011, p.120) but also finding that teachers' actual integration of Web 2.0 technology in classrooms may not reflect these perceptions.

It is therefore possible that the positive outcomes of this study may have been simply due to the students' initial curiosity about using a tool which was new to them and perhaps a longer, more in depth study would reveal that the students' enthusiasm for webtools wanes with increased use. There may also be a point in which students find that they use Web 2.0 tools too much. Buzzetto-More (2008, p.116) found that respondents in their study said that: *"…poor use of technology can detract from the learning experience and that technology should support, not replace, face to face learning"* which confirms that this study may have produced different findings if the webtools were trialled poorly or exclusively by the researcher.

CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

The purpose of this study was to find out secondary school students' perceptions of using ICT based teaching tools and Web 2.0 tools in science lessons, so that the researcher, a practicing science teacher, could use the findings to influence her teaching and inform best practice in her school. This study, therefore, presented the following research questions:

1. What are secondary school students' perceptions of using the following ICT based teaching tools: a. Commercial sites e.g. Kerboodle and b. Teacher generated course websites, in science lessons?
2. What are secondary school students' perceptions of using the following Web 2.0 tools: a. Wikis, b. Etherpads and c. Corkboards, in science lessons?
3. Do secondary school students perceive that Web 2.0 tools and ICT based teaching tools contribute positively to their: a. Learning, b. Enjoyment and c. Engagement, in science lessons?
4. Do Key Stage 5 students perceive that generating their own science content using: a. Wikis and b. Website generators, improves their learning?

In this chapter, following a brief reminder of the main findings of the study, the researcher suggests how these findings could be used to influence best practice with regards to the use of ICT technologies and Web 2.0 tools in the science classroom. The limitations to the study are then discussed and further research opportunities in this field are suggested.

This chapter is set out according to Figure 7.1 below:

7.1 Introduction

- Figure 7.1: Outline of the conclusions and recommendations chapter

7.2 Conclusion

7.3 Recommendations for practice

7.4 Limitations of the study

7.5 Suggestions for futher research

7.6 Final remarks

Figure 7.1: Outline of the Conclusions and Recommendations chapter

7.2 Conclusion

Research question 1 asked what students' perceptions were of using commercial and teacher-generated course websites, in their science lessons. It can be concluded that the secondary school students' in this study perceived that when Kerboodle was able to function as intended, it was beneficial to their learning. The students (n = 54) liked interacting with the Kerboodle tools (80%); thought it was easy to set up (80%); thought that it was easy to use (72%) and said the graphics and animations helped them to learn (74%). KS4 students felt that the teacher generated course websites were beneficial to their learning too. The students (n = 17) liked interacting with the website tools (71%); thought the website was easy to set up (76%) and easy to use (88%) and that the graphics and animations had helped them to learn (65%). The KS5 groups also believed that course websites enhance learning (mean = 4.19).

Research question 2 asked what secondary school students' perceptions were of using wikis, etherpads and corkboards, in their science lessons. This study concluded that wikis were viewed positively by students, as were etherpads, with Year 9 students finding that both assisted their learning. Etherpads were the feature the 30 Year 9 students enjoyed most about their lesson (9 students) with the idea of collaboration and learning more being the reasons given. The students (n= 28) indicated that they liked interacting with the wiki activities (64%); thought it was easy to set up (79%); thought that it was easy to use and navigate (93%) and found the wiki instructions clear (75%). In contrast with Kerboodle, only 11 of the 28 students (39%) said the graphics and animations helped them to learn when using the wiki. No students commented specifically about corkboards so this may require further investigation.

Research question 3 asked if secondary school students perceived that these tools contributed positively to their learning, enjoyment and engagement in their science lessons. Overall, the students who participated in this study largely viewed the ICT tools and Web 2.0 tools they used as being beneficial to their learning, engagement and enjoyment of their science lessons. 61% of the KS3 students felt that they were able to learn from the wiki; 86% said they were on task; 61% felt motivated and qualitative comments suggested students had no technological issues when using the wiki (26 of 28 students), though there were many suggestions for how to make it better. The researcher concludes that these types of comments show that this class engaged well with the wiki.

Similarly, 76% of the 54 KS3 and KS4 students felt that they were able to learn from Kerboodle; 72% said they were on task; 61% of students felt motivated and the KS3 group said there were no technological issues. However, one lower achieving KS4 group had negative experiences with Kerboodle due to technological issues which affected their engagement and learning; this has reduced these percentages dramatically. In contrast 88% of the 17 KS4 students felt that they were able to learn from the teacher-generated website; 82% said they were on task; 88% felt motivated and there were far fewer negative comments made.

Research question 4 asked if KS5 students perceived that generating their own science content using wikis and website generators improved their learning. This study concluded that the Key Stage 5 students perceived that generating science content using wikis and website generators improved their learning. They felt that they learned by using the wiki (mean = 3.64) and that the making the websites would improve their grade (mean = 3.67) as they encouraged revision and reading around the subject and helped students to have a deeper understanding of the course material.

7.3 Recommendations for practice

The researcher reiterates at this point that this study was conducted with small groups of KS3, KS4 and KS5 Chemistry students at a UK school and in addition to recommendations for similar schools there may be suggestions which are applicable for other audiences. There are several free Web 20 tools available to the educator and the researcher recommends that the educator spends time reviewing the features of each before using one with a class. This is due to the several issues the educator may experience when working with webtools in schools.

Firstly, setting up some Web 2.0 tools, such as wikis or course websites, may be time consuming and the researcher recommends that educators should consider working with others from the outset in order to share the workload. Maintaining a teacher-made site, or wiki, may also become a chore. Holcomb *et al.* (2007) who conducted a study in the US, commented that:

> "…*an increasing number of teachers are developing classroom websites but in general a relatively small population of teachers nationally, regularly maintain their sites*." (p.11)

This could be due to other commitments or poor initial planning of the site before rolling it out to students. The researcher recommends that any course website made by a teacher is populated and trialled well before introducing it to a class, preferably at the start of the school year. The number of hours this may require should not be underestimated. Unfortunately, time will not only be needed for the organisational 'pruning' and moderating of the wiki or website, but also for planning how the wiki or website is to be used effectively in the lesson. As discussed previously, a lesson involving Internet-based tools may require more planning than first thought by some teachers (Childs *et al.*, 2007).

In this respect, wikis and websites are like other web based learning tools (WBLTs). In a similar study, Kay *et al.* (2009) agreed with this recommendation, stating that:

> *"Overall most teachers rated WBLTs as easy-to-use tools that engaged students and promoted successful learning. Technological problems related to WBLTs were not reported often and focused mostly on the speed of the internet. The main suggestion offered by*

> *teachers was to be prepared to spend time selecting, testing and preparing the materials in order to ensure successful use of WBLTs."* (p.43)

It is therefore recommended that when planning to use Web 2.0 technologies, the educator trial the tools with colleagues and consults both their institution's technical support before first use with students, in order to ensure a successful experience. Even so, the educator may find that issues only become apparent when a group of users use the same tool simultaneously. For example, when using a wiki, in the researcher's classes, some students experienced frustration when attempting to work on the same page at the same time, and subsequently found that their work was overwritten when one student saved the page.

Engstrom and Jewett (2005) found that this was also a problem in their study, but reported that the teachers who had put students in small groups had more success. The researcher also found that allowing students to create their own individual page overcame this issue, although this may seem to somewhat defeat the objective of using a wiki as a collaborative site. Therefore the recommendation is that when using wikis, the teacher place students in small groups with each student having a specific role so a collaborative experience is encouraged whilst overcoming avoiding the technological issue.

Also, with respect to wikis or similar collaborative editing tools, this study suggested that students may not like their work being edited by others. Wheeler *et al.* (2008) also found that students had issues with wikis with regards to a resistance to having their work edited or deleted by their peers. However, the recommendation is not that the teacher forbids students to edit one another's work. If this aspect of a wiki is not utilised, this may negate the original objective of collaborative learning through content generation. Wheeler (op. cit.) also found that individual students tended to read only those pages to which they had contributed. However, *"In situations where content was jointly developed by small groups of students, more reading was undertaken across several pages*." (p. 993). The researcher recommends that students may be more willing to both read and edit others' work if this work is completed in small groups.

This study has suggested that both commercial sites, such as Kerboodle, and teacher-made course websites can be beneficial to students. The researcher recommends that when choosing which is more appropriate, an institution should consider the initial time to set up the website, which may be great for both types if student accounts must be created, and how much autonomy the institution wishes to have over the site. Although a commercial service is likely to come with a large number of pre-made resources, there may be several features over which the educator has little or no control, such as layout, graphics and initial content. This study found that these aspects were important to learners. In contrast, a teacher-made site could be entirely cost-free and simple to edit, but making the site and uploading resources may be time consuming and the graphics or animations may appear less professional. The recommendation here is that the educator trials teacher-generated websites with a small group of students and gains feedback on these aspects before using the site with a class. If selecting a commercial package, the educator, with colleagues, should set up a test account and attempt to use the site 'as if they were a student' in order to identify potential issues the students may experience.

Other recommendations concerning teacher-generated course websites can be based on suggestions of the functions of course websites made by Holcomb *et al.* (op. cit.). As a course website is a location to publish student work, such that students can take pride in others' seeing their work, potentially globally, it is recommended that students use initials or pseudonyms when authoring, in order to protect their identity. Students in the researcher's study did not indicate a desire for their published work to be less public and this may have been due to the measures taken by the researcher to ensure this.

Commercial or teacher-generated course websites and wikis can contain resources which students can access anywhere, especially outside of school. They are a good way of sharing these resources between teachers, between students and between teachers and students. However, this research has highlighted that having a username and password, which may be forgotten, may hinder access to these resources. It is therefore recommended that, if possible, course websites should not require students to log in to access these resources. As this may mean the site is visible to any user, the educator must ensure that uploaded resources are appropriate, are not plagiarised and adhere to copyright laws. The researcher recommends that simple usernames and passwords are used for wikis to allow the safety of a "walled garden", not visible to other users, but still able to be accessed easily by students. When setting up usernames and passwords, it may be beneficial for the educator to use students' existing school network usernames and allow them to set their own password.

Wikis and course websites may also be viewed (Holcomb *et al*., 2007) as a method of providing a link between home and school; and a way of projecting teachers' professionalism to the public, showing that teachers are preparing students in ways that integrate ICT and classroom learning. It is therefore essential that the teacher has the required ICT skills to generate a professional, secure site. The researcher recommends that before undertaking the task of generating such a site, the educator receive appropriate training in doing this, which should include basic knowledge of HTML to enable them to embed items such as forums, other Web 2.0 tools or secure areas such as wikis in the course website.

Further recommendations for best practice concern pedagogy (the method and practice of teaching) and students' learning behaviour. Although this study advocates the use of ICT for improving teaching and learning, some studies suggest that time spent on computers by students should be closely monitored. Lei and Zhao (2005) when reporting on the use of technologies in middle schools stated:

> *"The results from this study suggest that first although spending some time on computers may help students increase their learning outcomes, too much time on computers can be harmful…students tended to spend more time using computers in ways not likely to increase their academic achievement."* (p.293)

Therefore it is recommended that ICT is used sparingly and effectively in science lessons and should not fully replace classroom-based activities. It is also essential that lessons are tightly planned to minimise off-task behaviour. Although this study has suggested that student engagement increases with the use of Web 2.0 tools, the experience of Focus Group C illustrates that student engagement and learning may deteriorate quickly if the group experiences technology-based issues during the lesson, which may encourage some to use the computer for unrelated activities. Lei and Zhao (2005) agree that:

> *"…new regulations and classroom disciplines may be necessary to help students resist distractions and make better use of available technology and resources."* (p.295)

Although educators may find that student behaviour appears to improve when using Web 2.0 tools, the very nature of being connected to the Internet may prove a huge distractor for some students and it is imperative that the teacher considers how to combat this early on when planning to use Web 2.0 tools with a class. Some webtools may also have distracting aspects built in to the tool. The problems associated with the chat facility on the etherpads did not initially occur to the researcher but through trialling them with Focus Group D, the researcher was able to judge that Focus Group A may not benefit from its use. It is recommended that if planning to use etherpads, especially with KS3 and KS4 classes, educators do not allow the students to use the chat facility initially. In the researcher's study, use of etherpads in further science lessons may have led students to use the chat facility more appropriately and this may warrant further investigation.

7.4 Limitations of the study

This study, unfortunately, has a few limitations. The limitations are concerned with confidentiality, type of sample, validity and reliability. Firstly, and unavoidably, the researcher was one of only two full time Chemistry teachers in the school in which the study was conducted which meant that the researcher taught all of the students who participated in the study. Therefore the results may be subject to bias as the students had direct contact with the researcher, who was always present during the data collection. The students may have not answered all of the survey questions truthfully as they may have wanted to please their teacher by responding in a way which supported what the teacher was trying to achieve in the lesson; increased learning, enjoyment and engagement. Other students may have responded negatively for a similar reason; they may have not liked the teacher or the subject. This limitation is also noted by Brodahl *et al*. (2011) who reasoned that students may have completed their questionnaires diligently or may have avoided giving critical responses. It is also possible that these two extremes may have cancelled each other out when calculating the means, but the results still have a certain degree of uncertainty and must be interpreted with some caution.

Secondly, as with the research conducted by Brodahl *et al*. (op. cit.) this study was conducted with small opportunistic samples. The maximum group size in this study was a class of 31 students (Focus Group A) which is small for a study of this breadth. One survey was answered by only 8 students in some places. This means that it is not be possible to confidently extrapolate the results of this study to the wider population as the opinions stated may not represent those of all the students at this school. The researcher acknowledges that in retrospect more valuable and more reliable results may have been obtained from a narrower study of one or two webtools with a larger number of participants. Dale and Povey (2009) supported the view that using a small population meant that caution should be expressed when making generalisations. Brodahl *et al.* (op. cit.) also agreed that replication of this study with a larger population may have questioned or confirmed these results and enabled the researcher to make more generalisations.

Although a greater amount of measurement validity has been ensured by the triangulation between numerical data and qualitative responses, this study has a lower external validity because clearly this study cannot be generalised to other schools. How well the students involved in this study represent the larger population is unknown. This study also had some reliability limitations as each tool was only trialled over a short period of time with each group. In order to increase reliability, the researcher could have repeated the study using the same methods and compared the results. Also, as Cohen *et al.* (2011) suggest that, for example, "…*in interviewing there may be as many different interpretations of the qualitative data as there are researchers*" (p.202), another limitation of this study is highlighted; as only one researcher was involved, the interpretation of the qualitative results comes from only one viewpoint.

7.5 Suggestions for further research

The researcher suggests that there may be benefits to conducting a similar study with larger groups of students in several different types of establishment. Specifically, as there are few examples in the literature of the benefits to learning of students creating their own revision websites, there is potential for larger studies to be conducted in this area. It is postulated that an initial expansion of the project to a whole school initiative would provide more evidence for the success of the activity as larger numbers of participants would be involved and may also show if the website activity was able to be beneficial to students studying subjects other than chemistry.

Although there are several studies concerning blogs and wikis, few studies exist concerning the use of etherpads and corkboards in the science classroom. In this study only one Focus Group trialled these webtools in depth and this was only over a short period of time. An extensive study into the development of these technologies in the science classroom may prove useful to teachers wishing to embed real time collaboration into their lessons. In addition, a similar approach could be used for other emerging technologies such as the use of iPods and iPads, or other tablets in the secondary science classroom. Indeed, it may be interesting to investigate if students in deprived areas make more progress if these technologies are made available to them on a regular basis.

The researcher also suggests that a longer, more rigorous study could be beneficial in determining how these webtools could be used to promote better collaboration between groups of students and if different age groups find these webtools more beneficial to their learning than others. Investigation into the effectiveness Web 2.0 technologies from a social viewpoint and a comparison between tools that students use at home and in the classroom may also give further insight into potential areas for development.

It is worthy of note that, during the course of the study, the researcher learnt about other Webtools which could have potential benefits to students. Yola underwent a major update in 2013 which resulted in many of the students' websites becoming unreliable. The researcher then began to explore other free website generators and discovered that Weebly (www.weebly.com) could have been used by the students to produce websites instead. After making a few Weebly sites, the researcher determined that the reliability of these sites was better than the previously made Yola sites. The researcher's interest in using only Yola changed at this point and subsequent groups were given the option of using Weebly or Yola when making their student-generated revision websites. Repetition of the study using Weebly rather than Yola may be of benefit to some educators.

7.6 Final remarks

If money was no object, secondary schools would have the potential to invest in significant improvements to their ICT infrastructure and hardware. Many schools may choose to invest in laptop computers or emerging technologies such as tablets through which the Internet can be accessed easily at all times in all classrooms or even outside in the playground. Others would possibly buy in commercial packages such as Kerboodle. In the first scenario, certain free webtools, such as etherpads, may prove invaluable in assisting real-time collaboration between peers. Other online content generation tools such as wikis, which students can edit, could help to demonstrate an understanding of important concepts or more simply provide a platform for the storage of relevant documents, photographs or movies. With improved access to the Internet in the classroom, students could eschew writing in their exercise book and choose to update their blog with what they have learned instead, and their classmates could comment on them at the end of the lesson. Schools may consider buying iPads or other tablets for their students in order to facilitate this.

This study has suggested that the students involved in the researcher's project would relish both scenarios as wikis, teacher-generated websites, commercial sites and etherpads were considered by the majority of the students involved to benefit their learning, enjoyment or engagement in their science lessons in some way. In the future, the researcher predicts that more schools will have improved Internet access in lessons so the potential for using these Web 2.0 technologies will increase. Whether schools choose to use free webtools such as those investigated in this study or commercial packages or VLEs is likely to depend upon initial funding, staff competencies and training and a proven record that these technologies benefit teaching and learning. Without increased bandwidth and a robust network infrastructure these technologies, however, become ineffective and students' behaviour and learning may suffer. It is therefore essential that any change to whole school practice is planned thoroughly and well in advance of implementation.

Nevertheless, great potential remains for the individual teacher to improve teaching and learning on a smaller scale by using free Web 2.0 tools providing the teacher can use the webtool effectively, make the tool attractive and easy to use by students and have time to plan and embed the tool into the teaching sequence appropriately. This study has shown that even on a small scale, Web 2.0 tools and technologies can have a positive impact on students' learning.

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APPENDICES

This section contains the appendices to the main report. References and appendices are not included in the word count for this document.

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APPENDIX 1: DEFINITIONS

Learning Space – a very vague term that can refer to any 'space', not necessarily online; could be a 'handheld' in the playground or a user file within a standalone application. (http://www.slideshare.net/maximise/vles-in-uk-schools#btnNext)

Learning Platform – The whole network including topology, hardware, operating systems, software, resources and user files that go towards providing an ICT environment for students. It usually combines several functions, such as organising, mapping and delivering curriculum activities. (http://www.slideshare.net/maximise/vles-in-uk-schools#btnNext)

Virtual Learning Environment - A learning environment which is virtual, that learning does not place within the physical environment of classrooms or lecture theatres, rather it can be accessed remotely and securely from any Internet connection, anywhere. It enables learning through the support of not only teachers but a whole range of advisory and technical support. It performs the functions of a Course Management System but also keeps track of students' progress as they work through the learning resources it stores. A VLE can be considered part of a managed learning environment (MLE) if the data it records on students' progress are passed to the college or school management information system (MIS). (http://www.slideshare.net/maximise/vles-in-uk-schools#btnNext)

e-Learning – Learning facilitated and supported through the use of information and communications technology. (http://www.jisc.ac.uk/elearning)

UGC – User generated content. Any data or media that is contributed by individual users of a website; abbreviated UGC; also called consumer-generated media, user-created content. (http://dictionary.reference.com/browse/user-generated_content)

APPENDIX 2: QUESTIONNAIRES

The questions in this questionnaire were adapted from Durham University's First Year Communications and IT in Teaching and Learning Questionnaire (October 2002): http://www.dur.ac.uk/cis/lt/cit/oct2/

KS3, KS4 and KS5 ICT Survey

Section 1: Participant information

Gender: Male Female

Age: 13 14 15 16 17 18 19 20-29 30-39 40-49 50-59 60+

Year: 9 10 11 12 13 Staff

Form group (if applicable):____________

Section 2: Computing experience and preferences

a. Number of years using a computer: Less than 2 2-4 5-7 8-10 More than 10

b. Rank as a computer user: Novice Basic Intermediate Advanced Expert

c. Do you have a computer at home? Yes – own Yes – family's No

d. What type of computer do you usually use? Desktop PC Mac Laptop Netbook iPad Other

e. Time spent using a computer per day (hours): None 1-2 3-4 5-6 7-8 9-10 12+

f. Time spent using a computer for studies per day (hours): None 1-2 3-4 5-6 7-8 9-10 12+

g. Frequency of Internet access: Many times a day A few times a day Daily Weekly Fortnightly Monthly

h. Time spent online per week (hours): None 1-4 5-8 9-12 13-16 17-20 21-24 25-28 28+

i. I enjoy using the Web: Strongly disagree Slightly disagree Neutral Slightly agree Strongly agree

j. My online activities consist of (circle all that apply): Shopping E-mail Instant messaging Gaming Other Downloading music Blogging Surfing School work

k. I prefer lessons which contain: No ICT Some ICT A lot of ICT ICT exclusively No preference

l. My confidence when using computers is: Very low Low Medium High Very high

m. My confidence when using a new program is: Very low Low Medium High Very high

n. My preference for learning support materials is: Paper based Computer based No preference Neither

o. When using your computer do you regularly switch between several applications at a time? Yes No

p. Do you like to have the television or music on whilst studying on your computer? Yes No

q. Tick the one that best describes you: I am sceptical of new Web tools and use them only when I have to.
I am usually one of the last people I know to use new Web tools.
I usually use new Web tools when most people I know do.
I like new Web tools and use them before most people I know do.
I love new Web tools and among the first to experiment with and use them.

r. Have you ever taken a fully-online course? Yes No

s. I am interested in taking a fully online course?
Strongly disagree Slightly disagree Neutral Slightly agree Strongly agree

t. I would rather take a course that meets: In person Online Both

u. How likely are you to be interested in a course about learning how to use webtools?

Very unlikely Unlikely Undecided Likely Very likely

Section 3: Hardware usage and ownership

	yes	no		yes	no
Have you ever used a camcorder?			Do you have a camcorder?		
Have you ever used a scanner?			Do you have a scanner?		
Have you ever used a webcam?			Do you have a webcam?		
Have you ever used a printer?			Do you have a printer?		
Have you ever used a digital camera?			Do you have a digital camera?		
Have you ever used a mobile phone?			Do you have a mobile phone?		
Have you ever used a Smartphone?			If yes, is it a Smartphone?		
Have you ever used a PDA?			Do you have a PDA e.g. Palm?		

Section 4: How do you rate your skills with using the following?

	NONE	**BASIC**	**INTERMEDIATE**	**ADVANCED**	**EXPERT**
a. Email					
b. A web browser e.g. Internet Explorer, Firefox					
c. A web authoring package e.g. Dreamweaver, Yola					
d. Windows & file management					
e. A word processing package e.g. Word					
f. A spreadsheet package e.g. Excel					
g. A presentation package e.g. PowerPoint					
h. A database package e.g. Access					
i. A programming language e.g. HTML, Fortran, C, Java					
j. A statistical package e.g. SPSS, Excel					
k. A graphical package e.g. Paint, Photoshop					
l. An animation package e.g. Flash					
m. Computer games					

Section 5: Do you know how to do these things?

	YES	NO	UNSURE
a. Send, read, forward and delete email messages?			
b. Use an address book to store email addresses?			
c. Filter email messages?			
d. Use/manage bookmarks (Firefox) or favourites (Internet Explorer)?			
e. Locate information/resources using search engines e.g. Google?			
f. Save documents in folders?			
g. Cut and paste information between applications e.g. Word and Excel?			
h. Use the help functions within an application?			
i. Add links within and link to other pages when web authoring?			
j. Design page layout (e.g. using frames, tables or layers) when web authoring?			
k. Manage a website (6 or more pages)?			
l. Enter and change the appearance of text e.g. bold, italics in Word?			
m. Insert graphics into Word?			
n. Create your own styles & templates in Word?			
o. Enter data and formulae to perform calculations in Excel?			
p. Create and modify graphs in Excel?			
q. Record or write macros in Excel?			
r. Convert a colour image to black & white in Paint or Photoshop?			
s. Make the background of an image transparent in Photoshop?			
t. Create an animation in a graphics package			

Section 6: How often do you use or contribute content to the following?

	Never	Yearly	Monthly	Weekly	Daily
a. Blog e.g. Tumblr					
b. Collaborative writing tools					
c. Own website e.g. Yola					
d. Podcasts					
e. Social bookmarking/Tagging					
f. Social photo tools e.g. Flickr					
g. Social networking sites e.g. Facebook					
h. Social video tools e.g. YouTube					
i. Virtual world e.g. Second Life					
j. Wikis e.g. Wikispaces, Wikipedia					

Section 7: How would you rate your overall experience with these Web tools?

	Very negative	Negative	Neutral	Positive	Very positive
a. Blog e.g. Tumblr					
b. Collaborative writing tools					
c. Own website e.g. Yola					
d. Podcasts					
e. Social bookmarking/Tagging					
f. Social photo tools e.g. Flickr					
g. Social networking sites e.g. Facebook					
h. Social video tools e.g. YouTube					
i. Virtual world e.g. Second Life					
j. Wikis e.g. Wikispaces, Wikipedia					

Section 8: Are you interested in learning how to use these Web tools?

	Yes	No	Don't know
a. Blog e.g. Tumblr			
b. Collaborative writing tools			
c. Own website e.g. Yola			
d. Podcasts			
e. Social bookmarking/Tagging			
f. Social photo tools e.g. Flickr			
g. Social networking sites e.g. Facebook			
h. Social video tools e.g. YouTube			
i. Virtual world e.g. Second Life			
j. Wikis e.g. Wikispaces, Wikipedia			

If you have any questions or comments about this survey, please write them below.

The questions in this survey were adapted from Yuen *et al.* (2011)

KS5 Perceptions of Webtools Survey

Section 1: Participant information

Gender: Male Female

Age: 13 14 15 16 17 18 19

Year: 9 10 11 12 13

Form group (if applicable):____________

Section 1: Opinions about web tools

	Strongly disagree	Slightly disagree	Neutral	Slightly agree	Strongly agree
Web tools help learners to develop communication and language skills					
Web tools allow learners to work through their ideas and promote critical reflection.					
Web tools bring learners' work to an authentic and wider audience.					
Web tools facilitate communication and feedback between learners and teachers.					
Web tools help learners to develop a sense of ownership.					
Web tools develop skills needed in today's modern technological world.					
Web tools promote learners to interact and build a learning community.					
Web tools allow learners to express individuality and creativity.					
Web tools allow learners to pose questions to the community.					
Web tools allow learners and/or teachers to share photos, music and videos.					
Web tools allow learners and/or teachers to hold forums to discuss topics of interest.					
Web tools allow learners and/or teachers to find and share educational resources.					
Web tools provide collaborative learning opportunities.					
Web tools promote knowledge sharing.					
Web tools encourage learners to add value to the applications as they use it.					
Web tools allow learners to share their opinions, experiences and perspectives.					
Web tools open classroom walls.					
Web tools appeal to digital native learners.					
Web tools allow learners to become content producers and not just receivers.					
Web tools allow learners to connect content, people, ideas and conversations.					

Section 2: Course Websites – please complete this section if you have ever accessed the course website

	Strongly disagree	Slightly disagree	Neutral	Slightly agree	Strongly agree
Overall I was satisfied with the course website					

I found the course website to be a helpful resource					
I used the course website to help me to understand course information					
I regularly used the course website to answer my questions					
I believe that course websites enhance learning					
I think that using the course website will improve my grade					
I would like to see course websites added to all of my courses					
I believe that course websites will play an important part in education in the future					
The course website helped to create a sense of community					
The course website increased my interactions with the teacher					
The course website increased my interactions with the other students in the group					
Course websites extend personal interactions					
I was satisfied with the content available on the course website					
I was satisfied with the online lecture notes available on the course website					
I found the online lecture notes to be a valuable resource					
The lecture notes were easy to print					
I think that reading/using the lecture notes will improve my grade					
I regularly completed the online quizzes					
I found the online quizzes to be a valuable resource					
I think that completing the online quizzes will improve my grade					
I find taking tests online convenient					
The quiz worked during my visit					
I liked that I received an instant grade after taking an online quiz					
I regularly visited the online specification					
I found the online specification to be a valuable resource					
I think that reading/using the online specification will improve my grade					
I regularly visited the online scheme of work					
I found the online scheme of work to be a valuable resource					
I think that using the online scheme of work will improve my grade					
I found the links contained on the course website to be valuable					
I regularly visited the links contained on the course website					
The course website is a good place for the instructor to place handouts					
I would prefer a paper copy of the handouts					
I emailed the teacher using the 24 hour reply system					
I received a reply within 24 hours					
I think the email system will improve my grade					
I regularly checked my email inbox for messages from the teacher					
I downloaded past papers from the course website					
I downloaded markschemes from the course website					
I think that downloading past papers/markschemes will improve my grade					
I would like to be able to contribute to the course website					

Section 3: Blog Questions – please complete if you have ever contributed to a blog

	Strongly disagree	Slightly disagree	Neutral	Slightly agree	Strongly agree
The blog environment is user-friendly					
I like expressing my professional opinion in blogs					
I like expressing my personal opinion in blogs					
I access my own blog regularly					
I access others' blogs regularly					
I respond to posts on my own blog regularly					
I expect other people to post comments on my blog					
Blogs are useful for communicating with teachers					
Blogs are useful for communicating with peers					
The process of writing feedback to peers is meaningful					
Writing blog entries helps me to reflect on my work					
Writing blog entries helps me to reflect on my personal life					

Section 4: Wiki Questions – please complete if you have ever accessed or contributed to the wiki

How many times did you access the wiki: Never 1-3 4-6 7-9 More than 9
How many times did you contribute your own ideas to the wiki: Never 1-3 4-6 7-9 More than 9
How many times did you comment on others' ideas on the wiki: Never 1-3 4-6 7-9 More than 9
How many times did you edit others' ideas on the wiki: Never 1-3 4-6 7-9 More than 9
Have your contributions on the wiki been edited or commented on by others? Yes No Don't know

	Strongly disagree	Slightly disagree	Neutral	Slightly agree	Strongly agree
It was useful to use the wiki for group work					
The wiki helped in producing good quality work					
The wiki was effective in supporting learning					
The wiki was effective in supporting engagement with course content					
It was easy to use the wiki initially					
It was easy to use the wiki after being shown how to use it					
It was effective to use the wiki in group work					
The text editor on the wiki was easier to use than MS Word					
The text editor on the wiki was more enjoyable to use than MS Word					
I liked commenting on others' work					
I liked editing others' work					
I liked that others could comment on my work					
I liked that others could edit my work					
The wiki made collaboration with others easier					
The quality of collaboration in the group increased with the use of the wiki					
The wiki motivated me to collaborate with others in the group					
I felt that I learned something by using the wiki					
I felt that others will learn by using the wiki					
There were no technology based issues with the wiki					
I was comfortable with the degree of publicity of the wiki					
I would have preferred the wiki to be less public					

Section 5: Yola Revision websites – please complete if you have used Yola to make a website

	Strongly disagree	Slightly disagree	Neutral	Slightly agree	Strongly agree
Overall I was satisfied with the website I made					
I found making the website to be helpful for revision					
I used the instructions to help me to understand how to make my website					
The instructions were easy to understand					
I regularly visited my website throughout the course					
I regularly updated my website throughout the course					
I believe that revision websites enhance learning					
I think that making the revision website will improve my grade					
I think that making the website wasted my time					
I would have rather completed a different activity in the class time spent making the websites					
I think making the website was detrimental to my learning					
I learnt new ICT skills when making the website					
I think that the ICT skills I used when making the website will be useful in the future					
I would like to make websites for all of my subjects					
I believe that revision websites will play an important part in education in the future					
The revision website exercise helped to create a sense of community					
The revision website increased my interactions with the other students in the group					
I was comfortable with the level of publicity of my website					
I was satisfied with the tools available on the Yola website					
I was satisfied with the other features I could add to my website					
I think other students will find my website to be a valuable resource					
I added online quizzes or games to my website					
I think that online quizzes improve enjoyment of websites					
I think that completing my online quizzes will improve others' learning					
The quiz or game software worked and was easy to use					
I added music to my website					
I found adding music to the website was easy to do					
I added diagrams and/or pictures to my website					
I found adding pictures and diagrams to the website was easy to do					
I added links to my website					
I regularly visited my classmates' websites					
I had no technical issues when making the website					

If you experienced any issues when making the website please comment on them below.

If you have any ideas for improvement of the course website, revision website task or wiki please comment below.

Any other comments

The following evaluation scales are based upon ideas from Kay *et al*. (2009) and Brodahl *et al*. (2011):

Webtool evaluation scale for teachers

Section 1: Participant information

Gender: Male Female

Age: 18 19 20-29 30-39 40-49 50-59 60+

Form group tool was used with: ____________

	Strongly disagree	Slightly disagree	Neutral	Slightly agree	Strongly agree
The graphics and animations from the Web tool helped the students to learn.					
The students were able to learn from the Web tool.					
The Web tool was easy for students to use.					
The Web tool was easy to learn how to use.					
The students found the Web tool instructions clear.					
The students liked interacting with the Web tool.					
The students were on task while using the Web tool.					
Students were motivated while using the Web tool.					

What was the overall impact of the Web tool on the lesson?

Were there any technology-based problems that you encountered while using the Web tool? Please explain.

What information would you like to have in order to use Web tools more effectively in the future? Please explain.

What advice would you give to future teachers about using Web tools in their lessons? Please explain.

Year 10 Website evaluation scale for students

Gender: Male Female

Age: 13 14 15 16

Year: 9 10 11

Form group (if applicable):____________

	Strongly disagree	Slightly disagree	Neutral	Slightly agree	Strongly agree
The graphics and animations from the websites helped me to learn.					
I felt I was able to learn from the websites.					
The websites were easy for the teacher to set up.					
The websites were easy to learn how to use.					
I found the websites' instructions clear.					
I liked interacting with the websites.					
I was on task while using the websites.					
I felt motivated while using the websites.					

How did you use the websites in the lesson?

Were there any technology-based problems that you encountered while using the websites? Please explain.

What would make using these websites easier in the future? Please explain.

What advice would you give to teachers about using these websites in their lessons? Please explain.

Year 9 website evaluation scale for students

Gender: Male Female

Age: 13 14 15

Year: 9 10

Form group (if applicable):____________

	Strongly disagree	Slightly disagree	Neutral	Slightly agree	Strongly agree
The graphics and animations from the website helped me to learn					
I felt I was able to learn from the website					
The website was easy for the teacher to set up					
The website was easy to learn how to use and navigate					
I found the website instructions clear					
I liked interacting with the activities on the website					
I was on task while using the website					
I felt motivated while using the website					
I would visit the website again for revision purposes					

How did you use the website in the lesson?

Were there any technology-based problems that you encountered while using the website? Please explain.

What would make using the website easier in the future? Please explain.

How could the website be improved by the teacher to help students to learn?

What advice would you give to teachers about using websites in their lessons? Please explain.

Year 9 and 10 Kerboodle evaluation scale for students

Gender: Male Female

Age: 13 14 15

Year: 9 10

Form group (if applicable):____________

	Strongly disagree	Slightly disagree	Neutral	Slightly agree	Strongly agree
The graphics and animations from Kerboodle helped me to learn.					
I felt I was able to learn from Kerboodle.					
Kerboodle was easy for the teacher to set up.					
Kerboodle was easy to learn how to use.					
I found the Kerboodle instructions clear.					
I liked interacting with the Kerboodle tools.					
I was on task while using Kerboodle.					
I felt motivated while using Kerboodle.					

How did you use Kerboodle in the lesson?

Were there any technology-based problems that you encountered while using Kerboodle? Please explain.

What would make using Kerboodle easier in the future? Please explain.

What advice would you give to teachers about using Kerboodle in their lessons? Please explain.

Bridging Project Questionnaire

Name (optional):..

Age (please circle): 16 17 18

Subjects studied at AS:...

Before the holidays, I was informed that I could complete a bridging project over the Summer: Yes

No

I completed a bridging project over the Summer holidays (please circle): Yes – for one subject

Yes – for two subjects

Yes – for all three subjects

No

If you were informed about the bridging projects but chose not to complete one, please state your reasons

for opting out:...

If you chose to complete a bridging project, please answer the questions in the section below:

	Likert Scale				
	Strongly Disagree	Slightly Disagree	Neutral	Slightly Agree	Strongly Agree
The bridging projects were easy to access					
The bridging projects were easy to download					
The website was easy to use					
I would have preferred a paper copy of the bridging project					
I could get help with the bridging project when I needed it					
I would have preferred using a forum so I could discuss answers with others					
I enjoyed completing the bridging project					
I found the bridging project interesting					
I learnt new things by doing the bridging project					
I refreshed my memory of my science subjects by doing the bridging project					
Completing the bridging project has helped me have a good start to my AS courses					
Completing the bridging project has improved my confidence in my subjects					
I would recommend that other students complete a bridging project prior to starting their AS courses					

Please use this page to write about the impact the bridging project has had on your studies.

....

How could we improve the bridging project?

....

Any other comments or questions?

....

Science Pupil Voice Survey:

Evaluation of Lesson

Please answer these questions as honestly as you can. We are interested in your opinions about the last few lessons and the impact they have had on your learning.

Name ………………………………………………….

Rate your enjoyment in this lesson on the following scale (ring the answer which best suits your feelings)

I enjoyed the lesson…………..

Not at all Less than usual About the same as usual More than usual A lot

Question: What did you enjoy most about this lesson and why?

The thing I enjoyed most about the lesson was…….
This was because……

Think about the ICT you used during the lesson

Question: Did this technology help you learn about the concepts (ideas) related to the topic? (Ring the most suitable answer.)

No A little About the same Yes A lot Not sure

Question: If yes, how did this technology help you learn about the concepts (ideas) related to the topic?

Question: Did this lesson help you improve your reading or writing skills?

No A little About the same Yes A lot Not sure

Question: If yes, how did this technology help you **improve your reading or writing skills?**

Reading Writing

Question: Did the ICT in the lesson help you understand the meaning of keywords?

No A little About the same Yes A lot Not sure

Question: If yes, how did the ICT help you understand the meaning of keywords?

Rate your engagement (participation) in this lesson on the following scale (ring the answer which best suits your feelings).

I participated in the lesson………..

Not at all Less than usual About the same as usual More than usual A lot

Question: Why do you think this was? (You can list as many reasons as you like.)

Thank you for completing this survey. Please give it back to your teacher whn asked.

APPENDIX 3: ETHICAL CLEARANCE CHECKLIST

ETHICAL ADVISORY COMMITTEE

Loughborough University

Ethical Clearance Checklist

(TO BE COMPLETED FOR ALL INVESTIGATIONS INVOLVING HUMAN PARTICIPANTS)

If your research is being conducted off-campus and ethical approval has been granted by an external ethics committee, you may not need to seek full approval from the University Ethical Advisory Committee. However you will be expected to provide evidence of approval and the terms on which this approval has been granted. If you believe this statement applies to your research, please contact the Secretary of the Ethical Advisory Committee for confirmation.

If your research is transferring into Loughborough University and approval was obtained from your originating institution, there is a requirement on the University to ensure that appropriate approvals are in place. If you believe this statement applies to your research, please contact the Secretary of the Ethical Advisory Committee with evidence of former approval and the terms on which this approval has been granted.

It is the responsibility of the individual investigators to ensure that there is appropriate insurance cover for their investigation. If you are at all unsure about whether or not your study is covered, please contact the Finance Office to check.

Section A: Investigators

Title of Investigation

Name, Status and Email Address of Senior Investigators (University Staff Research Grade II and above): (Please underline responsible investigator where appropriate)

Department:

Name, Status and Email Address of Other Investigators (other University Staff and Students):

Department:

A1. Do investigators have previous experience of, and/or adequate training in, the methods employed?

Yes ☐ No† ☐ †If No, Please provide details below

A2. Will junior researchers/students be under the direct supervision of an experienced member of staff?

Yes ☐ No† ☐ †If No, Please provide details below

A3. Will junior researchers/students be expected to undertake physically invasive procedures (not covered by a generic protocol) during the course of the research?

Yes† ☐ No ☐ †If Yes, Please provide details below

A4. Are researchers in a position of direct authority with regard to participants (e.g. academic staff using student participants, sports coaches using his/her athletes in training)?

Yes† ☐ No ☐ †If Yes, Please provide details below

If you have selected one of the answers above marked with an † please provide additional information on how you intend to manage the issues (please continue onto a separate sheet if required), then submit this checklist to the Secretary to the EAC:

Section B: Participants

Vulnerable Groups

Will participants be knowingly recruited from one or more of the following vulnerable groups?

B1. Children under 18 years of age (please refer to published guidelines)	Yes# ☐ No ☐
B2. People over 65 years of age	Yes# ☐ No ☐
B3. Pregnant women	Yes# ☐ No ☐
B4. People with mental illness	Yes# ☐ No ☐
B5. Prisoners/Detained persons	Yes# ☐ No ☐
B6. Other vulnerable group (please specify)	Yes# ☐ No ☐

If you have answered 'No' to questions B1-B6, please now go to Section C

\# If the procedure is covered by an existing generic protocol which refers specifically to the vulnerable group(s), please insert reference number here

If the procedure is not covered by an existing generic protocol, please submit a full application to the Ethical Advisory Committee

Chaperoning Participants

If appropriate, e.g. studies which involve vulnerable participants, taking physical measures or intrusion of participants' privacy:

B7. Will participants be chaperoned by more than one investigator at all times?

Yes ☐ No* ☐ N/A† ☐ †If N/A, please provide details below

B8. Will at least one investigator of the same sex as the participant(s) be present throughout the investigation?

Yes ☐ No* ☐ N/A† ☐ †If N/A, please provide details below

B9. Will participants be visited at home?

Yes* ☐ No ☐ N/A† ☐ †If N/A, please provide details below

* Please submit a full application to the Ethical Advisory Committee.

If you have selected one of the answers above marked with an † please provide additional information on how you intend to manage the issues (please continue onto a separate sheet if required), then submit this checklist to the Secretary to the EAC:

Section C: Methodology/Procedures

To the best of your knowledge, please indicate whether the proposed study:

C1. Involves taking bodily samples Yes# ☐ No ☐

(please refer to published guidelines)

C2. Involves using samples previously collected with consent for further research Yes# ☐ No ☐

C3. Involves procedures which are likely to cause physical, psychological, social or emotional distress to participants Yes# ☐ No ☐

C4. Is designed to be challenging physically or psychologically in any way (includes any study involving physical exercise) Yes# ☐ No ☐

If the procedure is covered by an existing generic protocol, please insert reference number here

If the procedure is not covered by an existing generic protocol, please submit a full application to the Ethical Advisory Committee

C5. Exposes participants to risks or distress greater than those encountered in their normal lifestyle Yes* ☐ No ☐

C6. Involves collection of body secretions by invasive methods Yes* ☐ No ☐

C7. Prescribes intake of compounds additional to daily diet or other dietary manipulation/supplementation Yes* ☐ No ☐

C8. Involves testing new equipment Yes* ☐ No ☐

C9. Involves pharmaceutical drugs Yes* ☐ No ☐

(please refer to published guidelines)

C10. Involves use of radiation Yes* ☐ No ☐

(please refer to published guidelines). Investigators should contact the University's Radiological Protection Officer before commencing any research which exposes participants to ionising radiation – e.g. x-rays).

C11. Involves use of hazardous materials Yes* ☐ No ☐

(please refer to published guidelines)

C12. Assists/alters the process of conception in any way Yes* ☐ No ☐

C13. Involves methods of contraception Yes* ☐ No ☐

C14. Involves genetic engineering Yes* ☐ No ☐

* If you have answered 'Yes' to any of the above please submit a full application to the Ethical Advisory Committee

C15. Involves testing new equipment Yes† ☐ No ☐

† If you have answered 'Yes' to C15 please provide more information below (please continue onto a separate sheet if required), then submit this checklist to the Secretary to the EAC. Please attach a description of the new equipment and a risk assessment.

Section D: Observation/Recording

D1. Does the study involve observation and/or recording of participants?

Yes ☐ No ☐ If No, please go to Section E

If Yes,

D2. Will those being observed and/or recorded be informed that the observation and/or recording will take place? Yes ☐ No* ☐

* Please submit a full application to the Ethical Advisory Committee

Section E: Consent and Deception

E1. Will participants give informed consent freely?

Yes ☐ If yes please complete the Informed Consent section below.

No* ☐ *If no, please submit a full application to the Ethical Advisory Committee.

Note: where it is impractical to gain individual consent from every participant, it is acceptable to allow individual participants to "opt out" rather than "opt in".

Informed Consent

E2. Will participants be fully informed of the objectives of the investigation and all details disclosed (preferably at the start of the study but where this would interfere with the study, at the end)? Yes ☐ No* ☐

E3. Will participants be fully informed of the use of the data collected (including, where applicable, any intellectual property arising from the research)?
Yes ☐ No* ☐

E4. For children under the age of 18 or participants who have impairment of understanding or communication:

- will consent be obtained (either in writing or by some other means)?
Yes ☐ No* ☐ N/A ☐

- will consent be obtained from parents or other suitable person?
Yes ☐ No* ☐ N/A ☐

- will they be informed that they have the right to withdraw regardless of parental/ guardian consent? Yes ☐ No* ☐ N/A ☐

E5. For investigations conducted in schools, will approval be gained in advance from the Head-teacher and/or the Director of Education of the appropriate Local Education Authority Yes ☐ No* ☐ N/A ☐

E6. For detained persons, members of the armed forces, employees, students and other persons judged to be under duress, will care be taken over gaining freely informed consent? Yes ☐ No* ☐ N/A ☐

* Please submit a full application to the Ethical Advisory Committee

Deception

E7. Does the study involve deception of participants (i.e. withholding of information or the misleading of participants) which could potentially harm or exploit participants?
Yes ☐ No ☐ If No, please go to Section F

If yes,

E8. Is deception an unavoidable part of the study? Yes ☐ No* ☐

E9. Will participants be de-briefed and the true object of the research revealed at the earliest stage upon completion of the study? Yes ☐ No* ☐

E10. Has consideration been given on the way that participants will react to the withholding of information or deliberate deception? Yes ☐ No* ☐

* Please submit a full application to the Ethical Advisory Committee

Section F: Withdrawal

F1. Will participants be informed of their right to withdraw from the investigation at any time and to require their own data to be destroyed? Yes ☐ No* ☐

* Please submit a full application to the Ethical Advisory Committee

Section G: Storage of Data and Confidentiality

Please see University guidance on Data Collection and Storage

G1. Will all information on participants be treated as confidential and not identifiable unless agreed otherwise in advance, and subject to the requirements of law?

Yes ☐ No* ☐

G2. Will storage of data comply with the Data Protection Act 1998?

(Please refer to published guidelines) Yes ☐ No* ☐

G3. Will any video/audio recording of participants be kept in a secure place and not released for use by third parties? Yes ☐ No* ☐

G4. Will video/audio recordings be destroyed within ten years of the completion of the investigation? Yes ☐ No* ☐

G5. Will full details regarding the storage and disposal of any human tissue samples be communicated to the participants? Yes ☐ No* ☐

* Please submit a full application to the Ethical Advisory Committee

Section H: Incentives

H1. Have incentives (other than those contractually agreed, salaries or basic expenses) been offered to the investigator to conduct the investigation?

Yes† ☐ No ☐ †If Yes, Please provide details below

H2. Will incentives (other than basic expenses) be offered to potential participants as an inducement to participate in the investigation?

Yes† ☐ No ☐ †If Yes, Please provide details below

If you have selected one of the answers above marked with an † please provide additional information on how you intend to manage the issues (please continue onto a separate sheet if required), then submit this checklist to the Secretary to the EAC:

Section I: Work Outside of the United Kingdom

G1. Is your research being conducted outside of the United Kingdom? Yes ☐ No ☐

If Yes, you may need additional insurance cover/clearance for your research.

If, having completed this checklist, you will be making a full application to the EAC this issue will be checked for you as a part of the process. If however you do not need to complete a full application please contact Hiten Patel (H.Patel@lboro.ac.uk).

Section I: Declarations

Checklist Application only:

If you have completed the checklist to the best of your knowledge without selecting an answer marked with an * or †, your investigation is deemed to conform with the ethical checkpoints and you do not need to seek formal approval from the University's Ethical Advisory Committee. Please sign the declaration below, and lodge the completed checklist with your Head of Department or his/her nominee.

Declaration
I have read the University's Code of Practice on Investigations on Human Participants. I confirm that the above named investigation complies with published codes of conduct, ethical principles and guidelines of professional bodies associated with my research discipline. *Please sign below*

Checklist with additional information to the Committee:

If, upon completion of the checklist you have ONLY selected answers which require additional information to be submitted with this checklist (indicated by a †), please ensure that all the information is provided in detail and send this checklist to the Secretary to the EAC.

Full Application Needed:

If on completion of the checklist you have selected one or more answers which require the submission of a full proposal please download the relevant form from the Committee's web page.

A copy of this checklist, signed by your Head of Department should accompany the full submission to the Ethical Advisory Committee.

Signature of Responsible Investigator
Signature of Student (if appropriate)
Signature of Head of Department or his/her nominee
Date

Advice to Participants following the investigation: Investigators have a duty of care to participants. When planning research, investigators should consider what, if any, arrangements are needed to inform participants (or those legally responsible for the participants) of any health related (or other) problems previously unrecognised in the participant. This is particularly important if it is believed that by not doing so the participants' wellbeing is endangered. Investigators should consider whether or not it is appropriate to recommend that participants (or those legally responsible for the participants) seek qualified professional advice, but should not offer this advice personally. Investigators should familiarise themselves with the guidelines of professional bodies associated with their research.

APPENDIX 4: TIMELINE REFERENCES

1990 First web page (http://info.cern.ch/)

1995 First wiki installed on the Internet – WikiWikiWeb (http://c2.com/doc/etymology.html)

1997 The term "Weblog" coined by Jorn Barger (http://www.wired.com/entertainment/theweb/news/2007/12/blog_anniversary)

1999 Pyra Labs starts Blogger (https://www.blogger.com/about)

1999 Surveymonkey founded by Ryan Finley (http://www.surveymonkey.com/mp/aboutus/directors/)

2000 i2Go launch a system which enabled the selection, automatic downloading and storage of serial episodic audio content on PCs and portable devices – the first podcasts (http://www.mp3newswire.net/stories/2000/ego.html)

2002 First version of Moodle released (http://en.wikipedia.org/wiki/Moodle)

2003 David Weekly founds the company that will become PBworks (http://pbworks.com/about-us)

2003 Google buys Blogger (http://www.guardian.co.uk/business/2003/feb/18/digitalmedia.citynews)

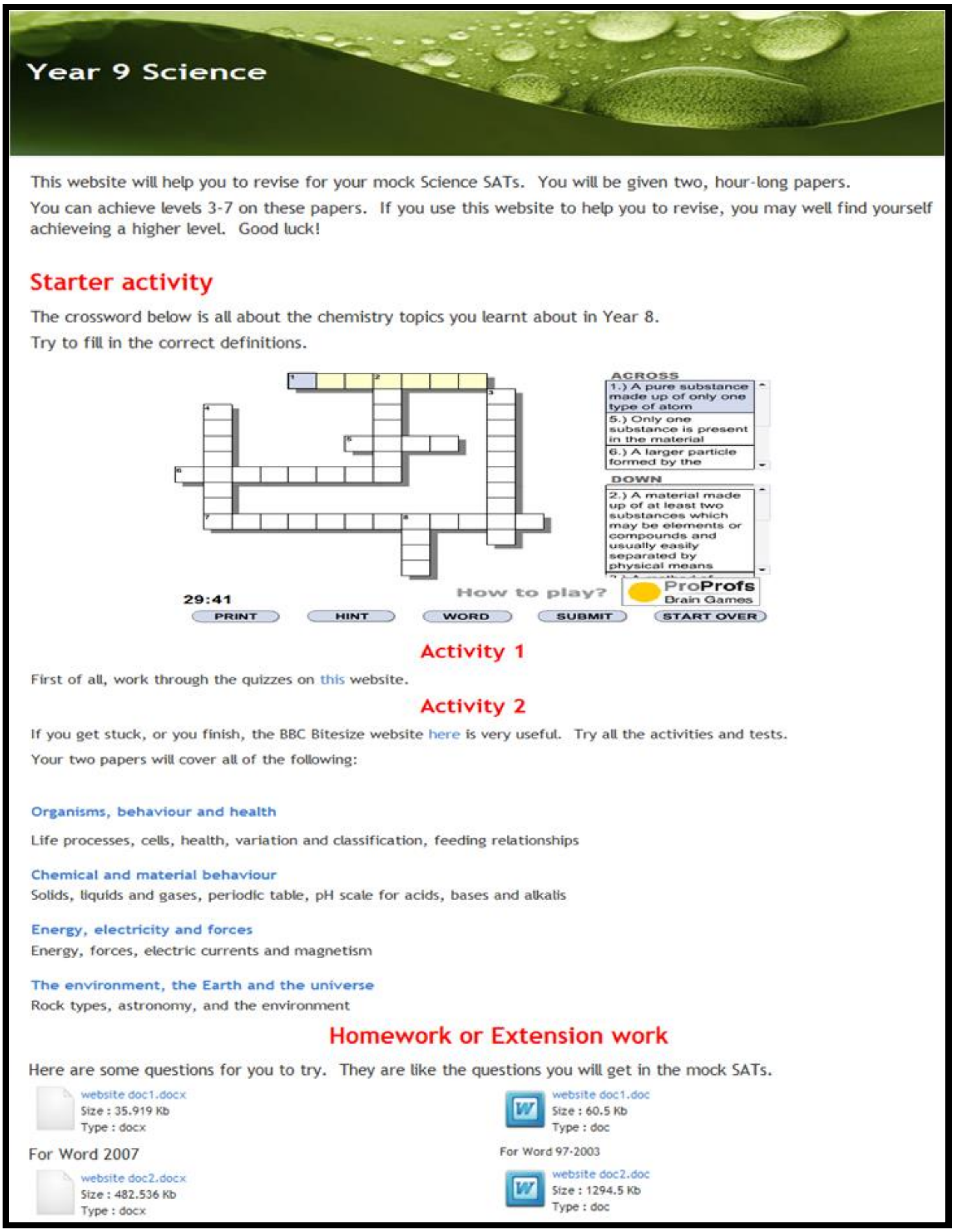
2004 Facebook founded by Mark Zuckerberg and colleagues at Harvard (http://www.guardian.co.uk/technology/2007/jul/25/media.newmedia)

2005 YouTube founded by Hurley, Chen and Karim (http://www.youtube.com/t/about_youtube)

2005 Wikispaces published on the Internet (http://www.wikispaces.com/about)

2006 Polldaddy founded in Ireland (http://polldaddy.com/about/)

APPENDIX 5: YEAR 9 WEBSITE


Year 9 Science

This website will help you to revise for your mock Science SATs. You will be given two, hour-long papers. You can achieve levels 3-7 on these papers. If you use this website to help you to revise, you may well find yourself achieveing a higher level. Good luck!

Starter activity

The crossword below is all about the chemistry topics you learnt about in Year 8.

Try to fill in the correct definitions.

Activity 1

First of all, work through the quizzes on this website.

Activity 2

If you get stuck, or you finish, the BBC Bitesize website here is very useful. Try all the activities and tests.

Your two papers will cover all of the following:

Organisms, behaviour and health

Life processes, cells, health, variation and classification, feeding relationships

Chemical and material behaviour

Solids, liquids and gases, periodic table, pH scale for acids, bases and alkalis

Energy, electricity and forces

Energy, forces, electric currents and magnetism

The environment, the Earth and the universe

Rock types, astronomy, and the environment

Homework or Extension work

Here are some questions for you to try. They are like the questions you will get in the mock SATs.

website doc1.docx
Size : 35.919 Kb
Type : docx

website doc1.doc
Size : 60.5 Kb
Type : doc

For Word 2007

For Word 97-2003

website doc2.docx
Size : 482.536 Kb
Type : docx

website doc2.doc
Size : 1294.5 Kb
Type : doc

Figure 9.5.1: Year 9 website (www.year9.yolasite.com)

Year 10 Chemistry Revision Lesson

C1a, Topics 5 and 6

Starter: Click on this BBC Bitesize link or this BBC Bitesize link and choose one of the topic areas from C1a.
You should choose a topic you are least familiar with.
Read through the revision pages for that topic.
You can also try the activities.

Main lesson: Create 6 flashcards in PowerPoint, summarising this information.
It must be bright, colourful and easy to read and remember.
Swap computers with the person sitting next to you and allow them to read through your flash cards for 6 minutes. You can even time each other.

Plenary: Now go back to BBC Bitesize and try the test for this topic. Can you get 100% correct?

You can try the Year 9 revision material when you have finished.

First of all, go to http://edu.glogster.com/ and click on "Try to create your glog".

Next, open up a new tab and go to http://www.bbc.co.uk/schools/gcsebitesize/science/aqa/rocks/metalsrev1.shtml

Use this site to make a glog poster about metals. Your glog must include information about titanium and aluminium and how they are recycled (see last page) and also any other pictures or information you think is relevant about metals and their extraction from ores. You can include anything you have learnt in lesson too!

Feel free to change the background, fonts, add pictures etc as you wish. Make your glog cool and funky.

At the end of the lesson you can either print your glog (right click, print) or save it. If you want to save it, I will give you a username and password.

Figure 9.5.2: Year 10 activities on the **www.year9.yolasite.com** website

APPENDIX 6: YOLA INSTRUCTIONS

How to create a free website with Yola

Follow these instructions carefully to create your revision website. Updating your website after every new topic will help your revision, as will accessing others' websites.

1. Basic set up
   a. Go to www.yola.com and click on Get started now
   b. Type in your full name, email address (school one preferably or at least one you can access at school) and an easy to remember password.
   c. From My Yola, click on Create new site. You will be able to create 5 free sites with one email address.
   d. Choose Blank site from the list. This will allow you to create your own pages as you want them.
   e. Give your website a name. I suggest you call it *Name's* OCR GCE Chemistry Revision. Don't use your full name, just your first name or a clean nickname will do, as long as I can identify you but you are still anonymous to other Internet users.
   f. Pick one of the free styles by clicking on Select a style.

2. Creating content
   a. Now, you can start creating the content. You will automatically be given a Home page. Drag the text widget from the right pane onto your site and type a short introduction in the box.
   b. If you want to split your site into panes or columns, use the column divider widget. Drag it from the right pane onto your site. You can delete it if you don't want columns. You can also make columns within columns and change the size of them by hovering over the divider, clicking and dragging it.
   c. If you wish to add a picture to your site, drag the picture widget onto your site. Be aware that you must either have your own picture saved, ready to select before continuing. The picture needs to be free from copyright (i.e. you took it or drew it) or from a free picture site with appropriate sourcing underneath. Do not just STEAL others' pictures from the Internet! This is not permitted!
   d. You can upload files in the same way by dragging the file widget onto your site and browsing for your file. This may be useful if you wish to create handouts or printable quizzes for your site.
   e. If you wish to embed a video or poll or something similar using source code, use the html widget. Copy the source code from what you wish to embed into the editor and click Save. This is a useful widget for inserting polls and surveys. You might like to register for a free account at polldaddy.com so you can do this.
   f. If you wish to have a new page, just click Add Page at the top and call your new page something appropriate e.g. Links.
   g. There are many more widgets you can explore on the right pane including Google Gadgets, YouTube videos and Google maps. You must develop your site to make it useful for yourself and other students but you might want to add a gadget to make your site fun and encourage others to revisit. Don't go mad with the gadgets – remember the original purpose of the site and remember everybody will soon be able to view it!

h. You can change the style, layout, background and navigation at any time by clicking on the links at the top.
i. Save your changes regularly by clicking on Save.

3. Publishing your site
a. You may want to publish this site before it is finished so you can see what it will look like to others. Click on Publish to the web. You are going to choose the free domain name option. Call your site *names*ocrchemistry.yolasite.com (the yolasite.com is already there) if that is available, or something similar if not. Again, don't use your full name.
b. When you have published your site, go to its web address and check the layout and aesthetics. Make any changes you want, save and re-publish. You must save and publish every time you make a change to your site.
c. Now you have the basics, start to write the text for your website. Remember this must be all in your own words and not plagiarised in any way! Happy site building!

It is to be noted that Yola underwent a major site update in May 2013 and therefore these instructions do not match the current site.

APPENDIX 7: POLL RESULTS

PAGE 1 OF 1

Q.1 Did you like the website lay out? *
- yes
- no
- don't know

Q.2 Was the site easy to find? *
- yes
- no
- don't know

Q.3 Do you prefer this to normal class work? *
- yes
- no
- don't know

Q.4 Which activity did you like the most? *
- Multiple Choice
- Crosswords
- Bitesize activities
- Fill in gaps

Q.5 Did you learn anything new today? *
- Yes
- No
- Not sure

Q.6 Do you like using the computers to do revision activities? *
- Yes
- No
- Not sure

Q.7 How did you find the questions? *
- Hard
- OK
- Easy

Q.8 I will now go and revise on the topics that I found more challenging... *
- Yes
- No
- Not sure

Q.9 I managed to try approximately ___ activites *
- 1-3
- 4-8
- 8+

Q.10 I would like to do this sort of lesson again... *
- Yes
- No
- Don't know

Finish Survey

PAGE 1 OF 1

Create Your Own Survey With Polldaddy.com

Figure 9.7.1: Poll on www.year9.yolasite.com, given to Year 9 students to gauge feedback

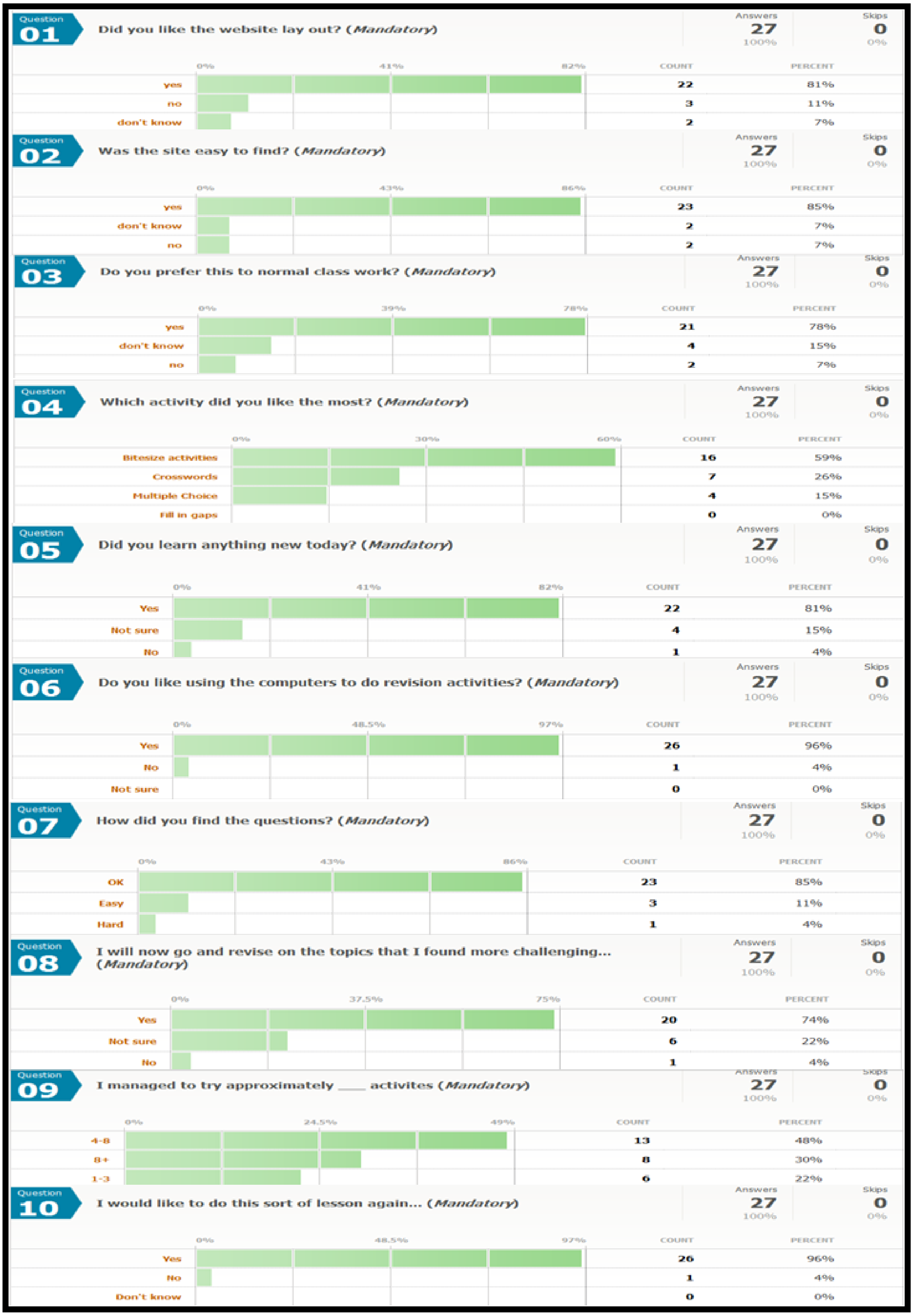


Figure 9.7.2: Results from Year 9 poll about using ICT for Science revision

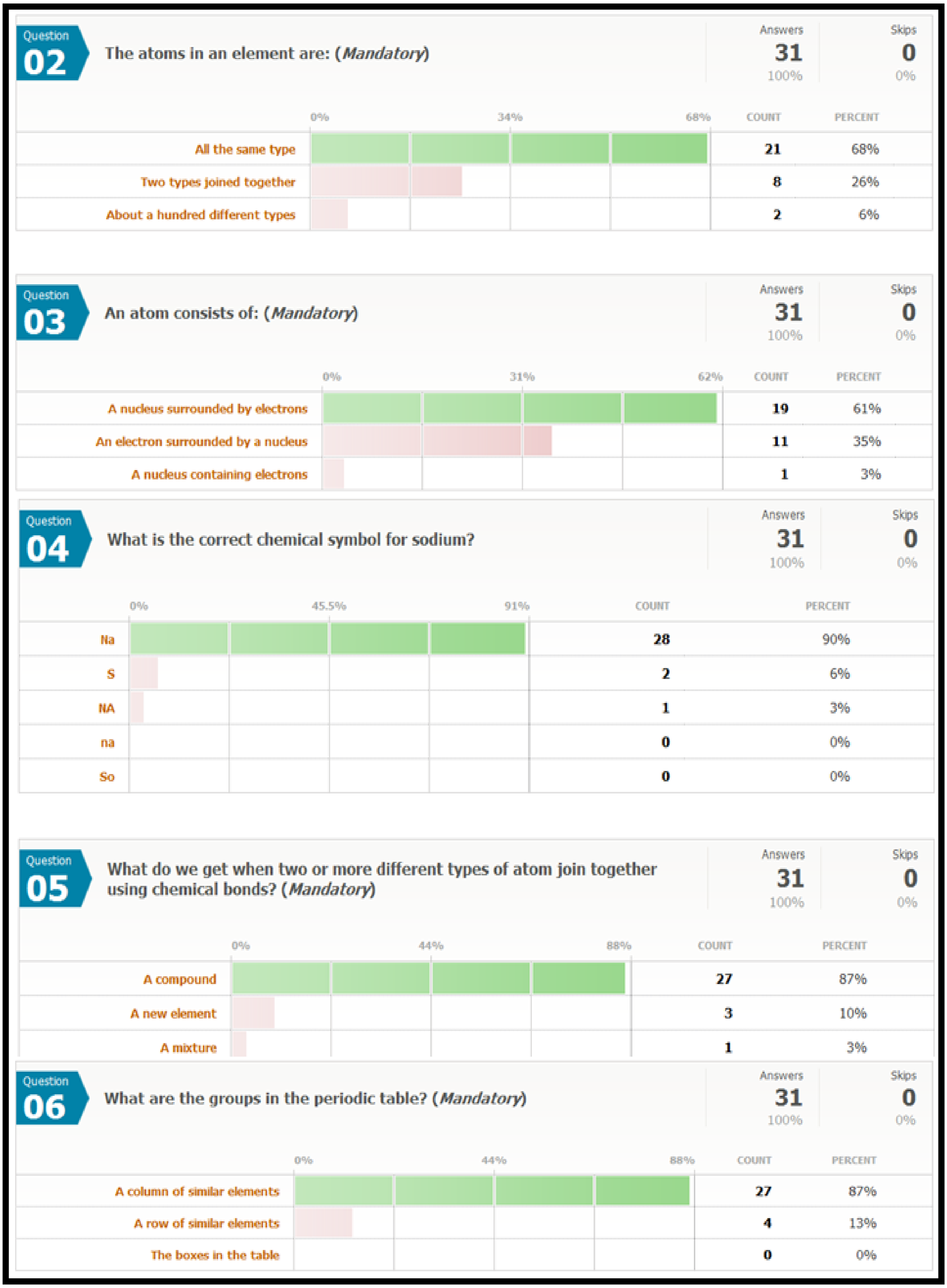


Figure 9.7.3: Polldaddy quiz about Atoms, Elements and the Periodic Table

(Q1-6 where Q1 asked the students to write their name)

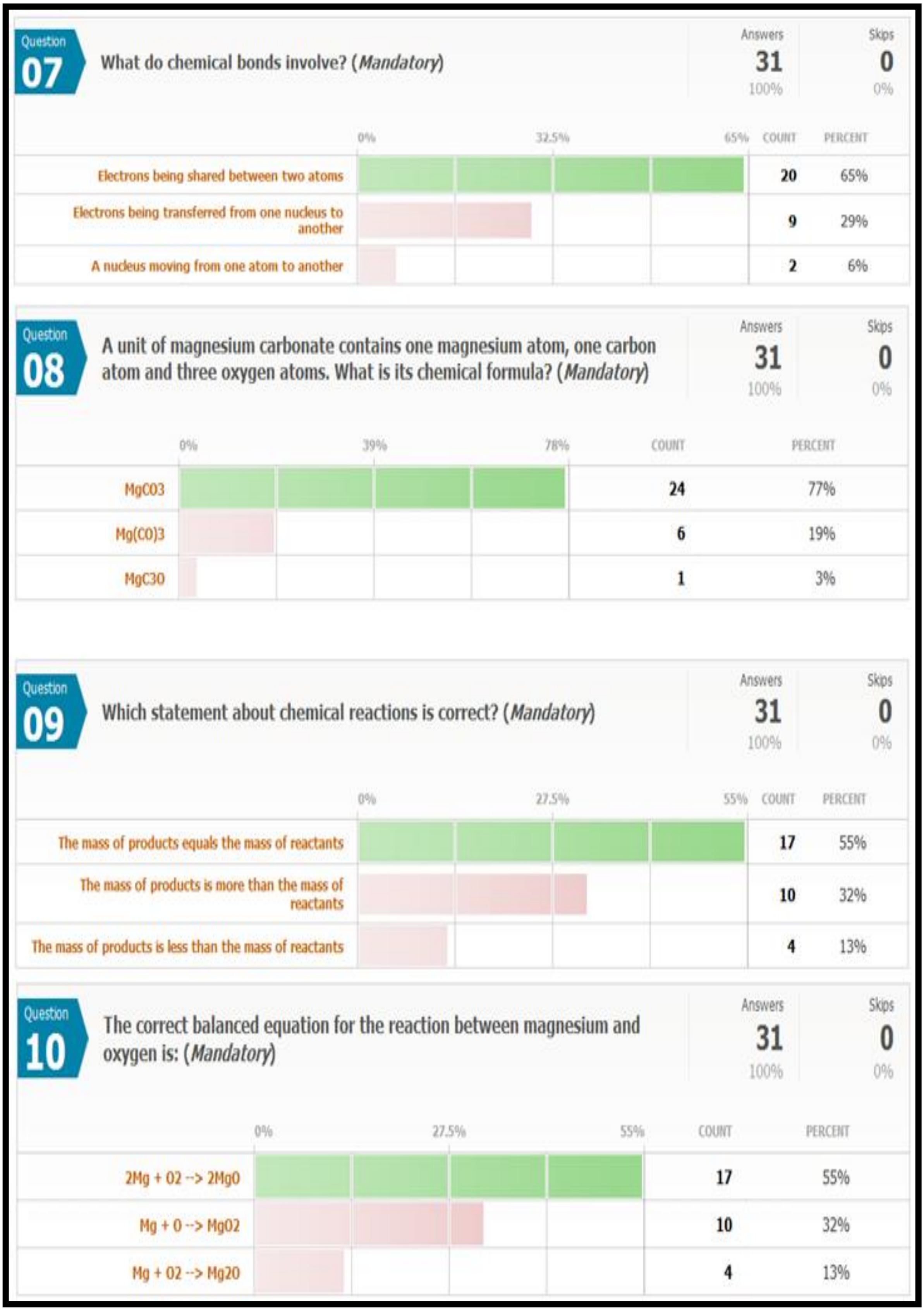


Figure 9.7.4: Polldaddy quiz about Atoms, Elements and the Periodic Table (Q7-10)

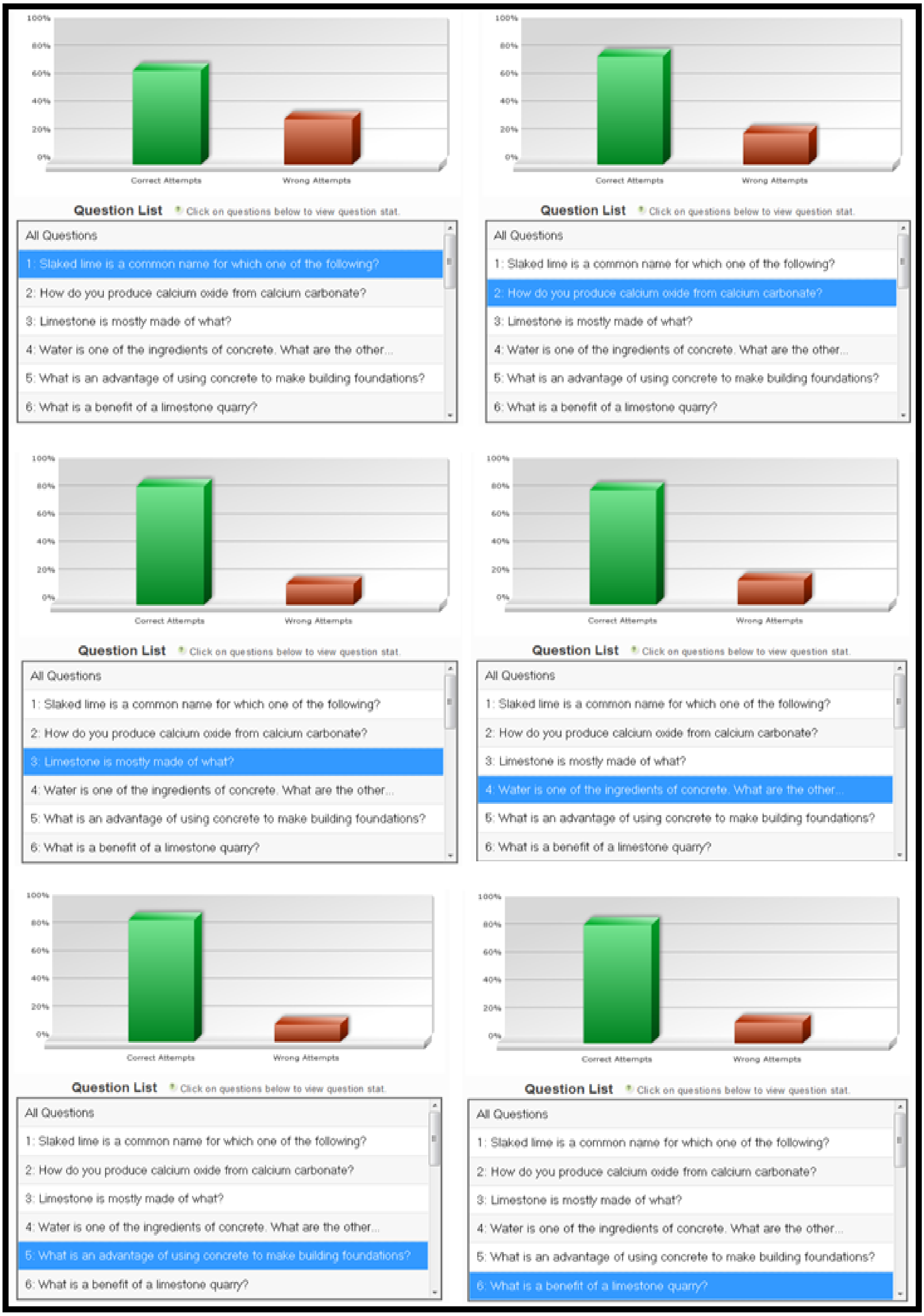


Figure 9.7.5: Proprofs quiz about Limestone and Metals (Q1-6)

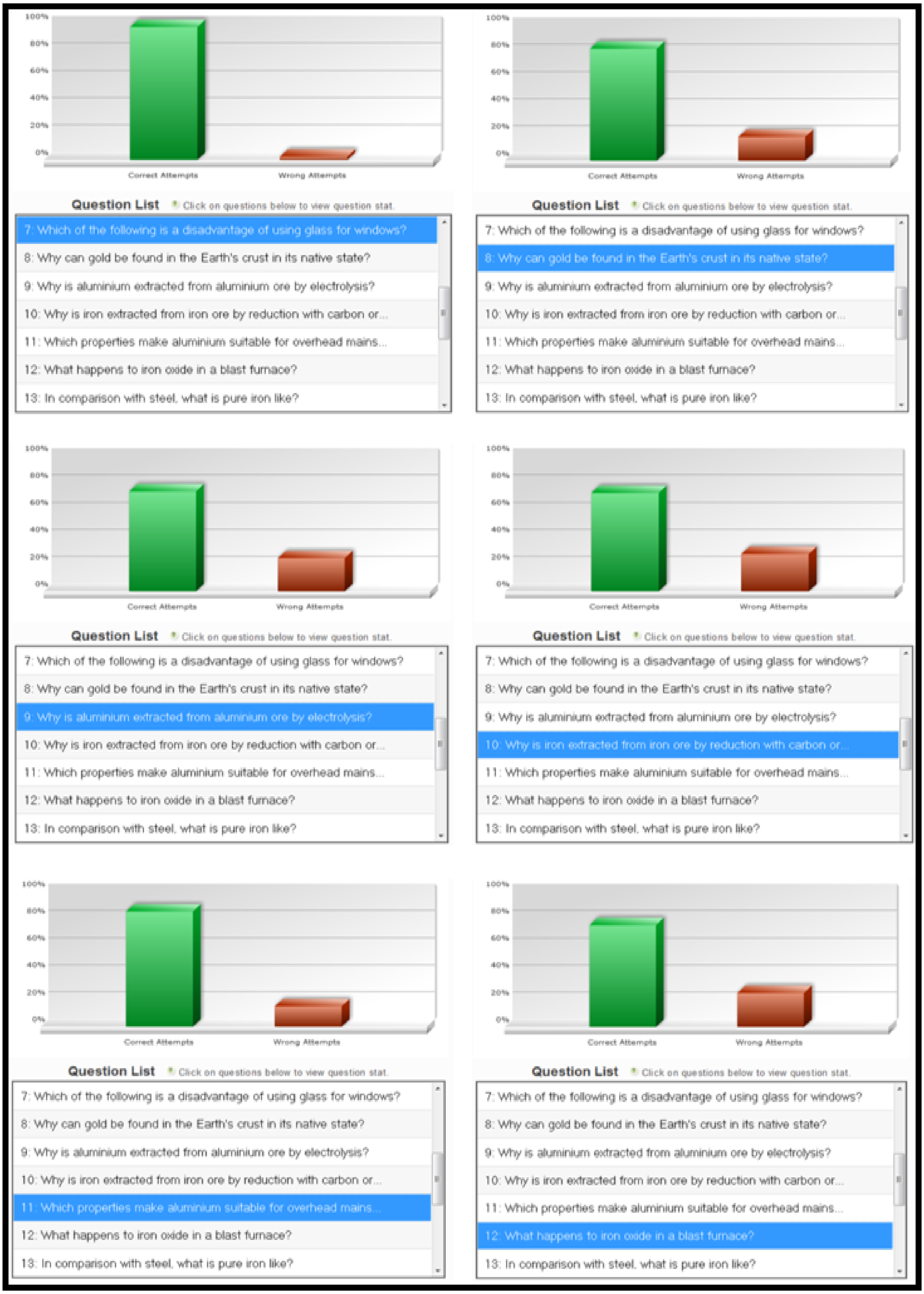


Figure 9.7.6: Proprofs quiz about Limestone and Metals (Q7-13)

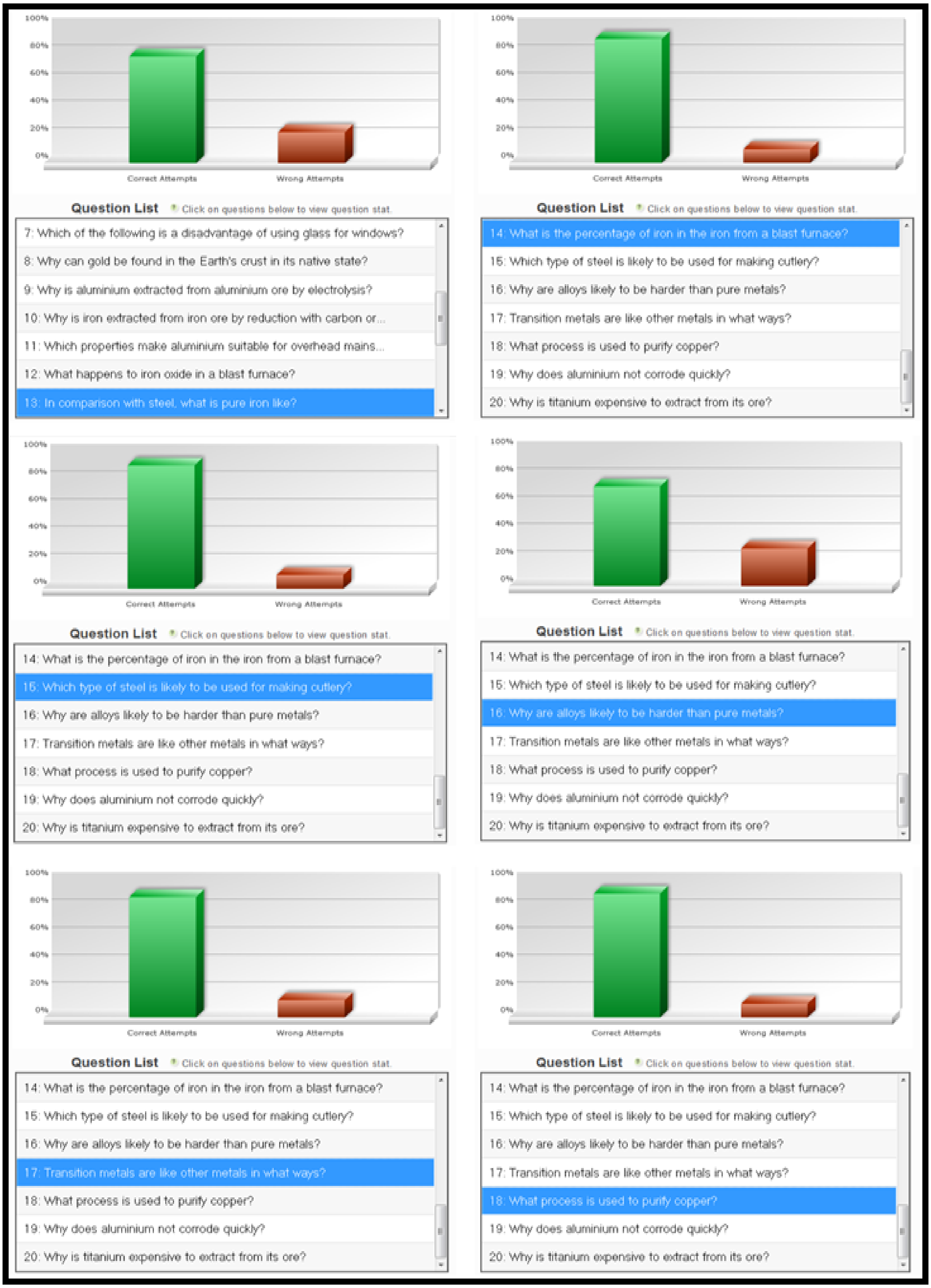


Figure 9.7.7: Proprofs quiz about Limestone and Metals (Q14-18)

Figure 9.7.8: Proprofs quiz about Limestone and Metals (Q19-20)

Nyle S-L	10327511	United Kingdom	100%	9 CORRECT OF 9
Markian L	10327285	United Kingdom	100%	9 CORRECT OF 9
Miss Turner	10272273	United Kingdom	100%	9 CORRECT OF 9
Catherine C	10327613	United Kingdom	89%	8 CORRECT OF 9
Michael O.	10327537	United Kingdom	89%	8 CORRECT OF 9
Rebecca L	10327533	United Kingdom	89%	8 CORRECT OF 9
Ryan S	10327527	United Kingdom	89%	8 CORRECT OF 9
Brianna S-H	10327502	United Kingdom	89%	8 CORRECT OF 9
Sophia I	10327465	United Kingdom	89%	8 CORRECT OF 9
Katie B	10327390	United Kingdom	89%	8 CORRECT OF 9
Ryan S	10343657	United Kingdom	78%	7 CORRECT OF 9
Klaudia R	10327478	United Kingdom	56%	5 CORRECT OF 9
Chibuye C	10327603	United Kingdom	78%	7 CORRECT OF 9
Emily T	10327525	United Kingdom	78%	7 CORRECT OF 9
Lucy E	10327482	United Kingdom	78%	7 CORRECT OF 9
Craig W	10327473	United Kingdom	78%	7 CORRECT OF 9
Georgia H	10328182	United Kingdom	67%	6 CORRECT OF 9
Hannah B	10327524	United Kingdom	67%	6 CORRECT OF 9
Crystal M	10327469	United Kingdom	67%	6 CORRECT OF 9
Michael M	10327462	United Kingdom	67%	6 CORRECT OF 9
Alex F	10327440	United Kingdom	67%	6 CORRECT OF 9
Louise C	10299505	United Kingdom	67%	6 CORRECT OF 9
Megan G	10327616	United Kingdom	56%	5 CORRECT OF 9
Chloe H	10327614	United Kingdom	56%	5 CORRECT OF 9

Figure 9.7.9: Results for Polldaddy quiz

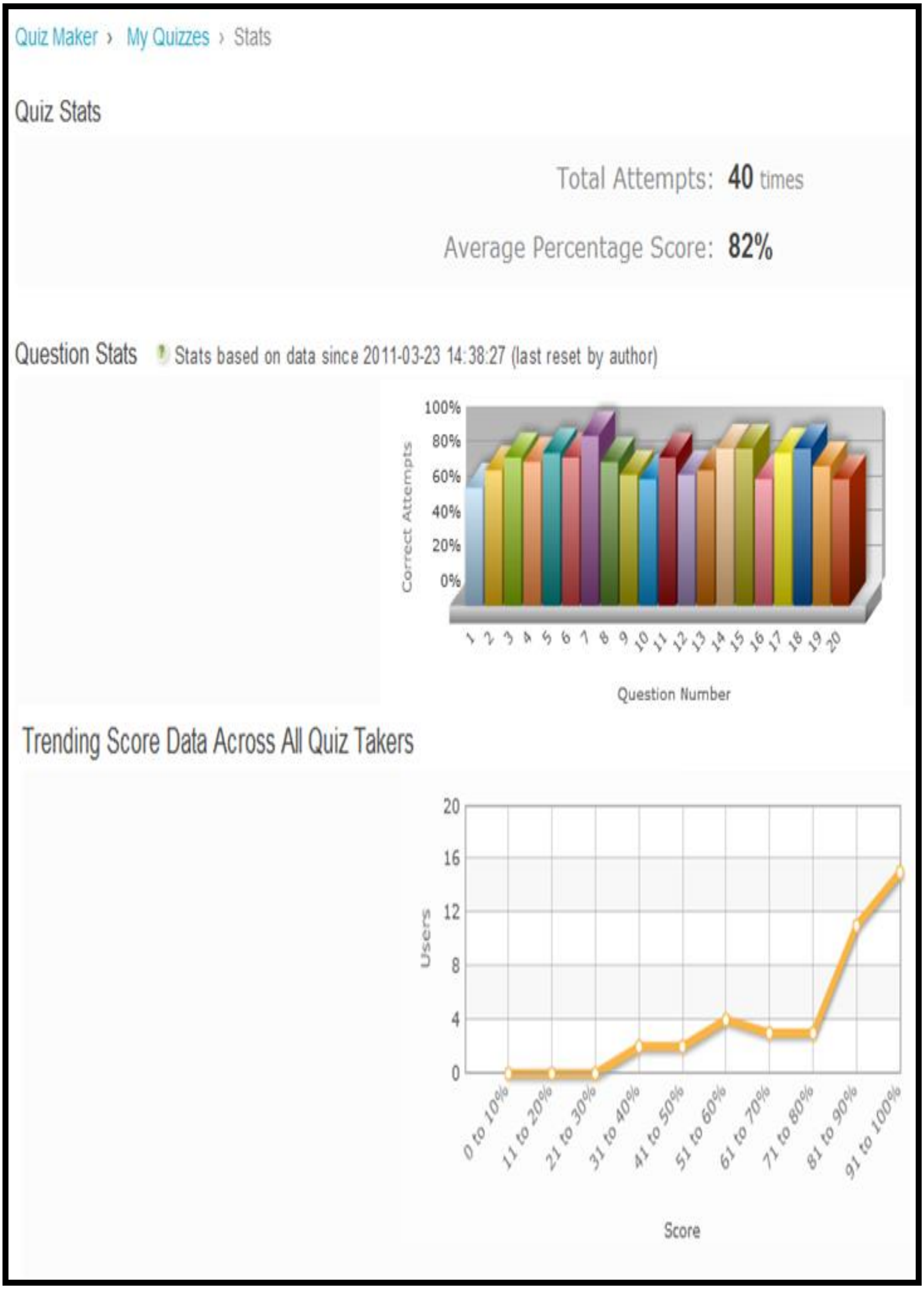


Figure 9.7.10: Statistics provided by the Proprofs website for the second quiz

Date	User Name	Time Taken	Score (%)	Score	Score Report	IP Address
Mar 23, 2011 07:53 PM	Miss Turner	2 mins 6 secs	100	100	view	86.145.96.80
Mar 24, 2011 03:06 PM	lOUSE	1 mins 10 secs	40	40	view	92.43.64.70
Mar 24, 2011 05:42 PM	sophie	3 mins 40 secs	95	95	view	86.150.246.41
Mar 25, 2011 01:12 PM	Katie B	8 mins 4 secs	85	85	view	92.43.64.68
Mar 25, 2011 01:14 PM	Alex F	7 mins 37 secs	65	65	view	92.43.64.70
Mar 25, 2011 01:17 PM	alfie	6 mins 38 secs	35	35	view	93.93.222.209
Mar 25, 2011 01:18 PM	Craig W	7 mins 40 secs	85	85	view	93.93.222.206
Mar 25, 2011 01:20 PM	Dawid Z	13 mins 16 secs	75	75	view	92.43.64.68
Mar 25, 2011 01:22 PM	Craig W	3 mins 19 secs	90	90	view	93.93.222.206
Mar 25, 2011 01:22 PM	emily	11 mins 12 secs	55	55	view	93.93.222.206

Figure 9.7.11: Results for Proprofs quiz

APPENDIX 8: CHEMHUB WEBSITE

Figure 9.8.1: Chemhub website linking the Year 13 websites created (www.chemhub.yolasite.com)

APPENDIX 9: GLOGS AND CORKBOARDS

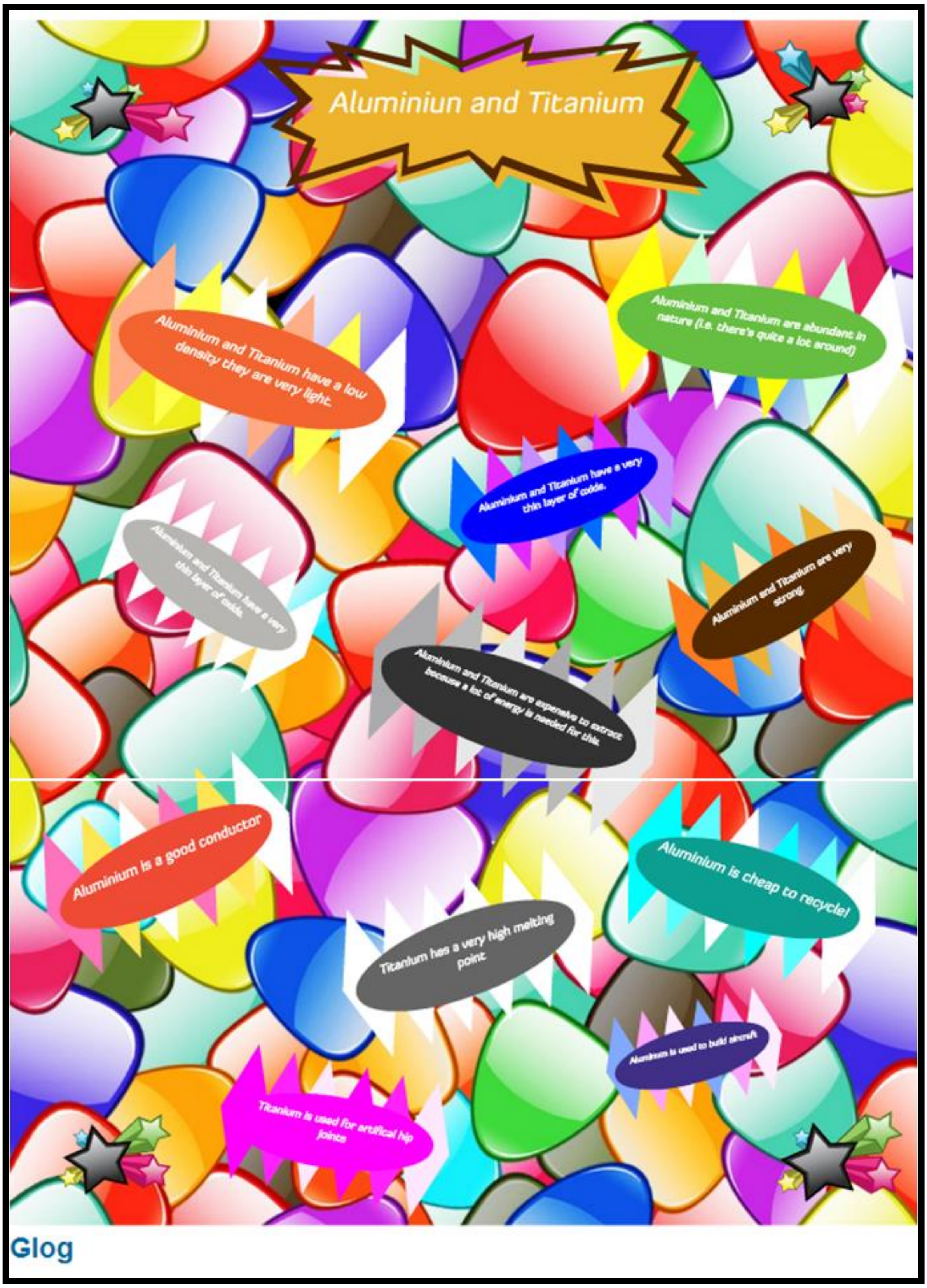


Figure 9.9.1: Craig from 9M's "Glog"

Figure 9.9.2: Michael from 9M's "Glog"

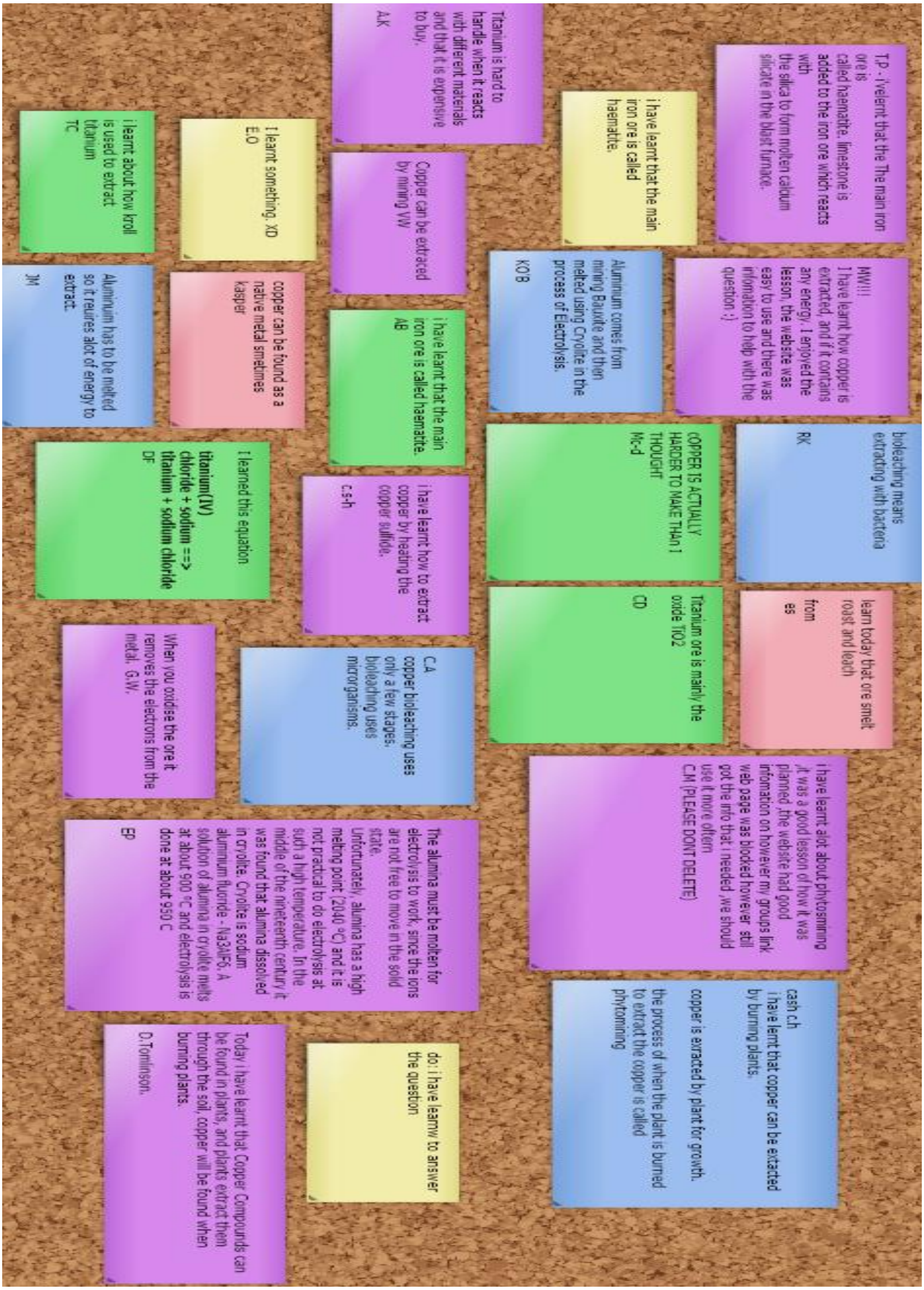


Figure 9.9.3: Corkboard for Year 9 metals lesson

APPENDIX 10: DATA

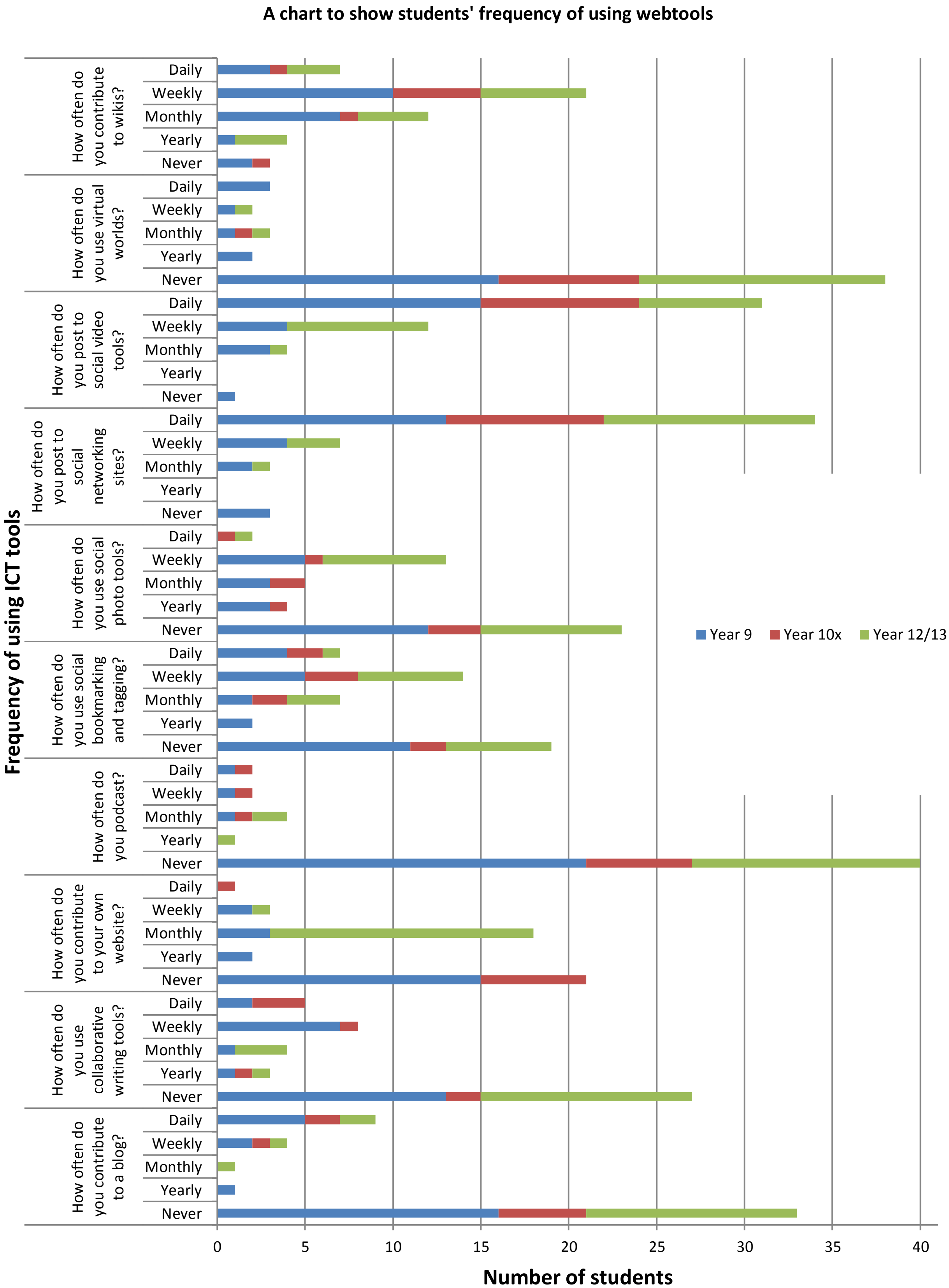


Figure 9.10.1: Students' current use of or contributions to Webtools

Current ICT situation		Year 9 KS3	Year 10x KS4	Year 12/13 KS5
Have you ever used a camcorder?	Yes	23	10	15
	No	2	0	1
Have you ever used a scanner?	Yes	17	7	14
	No	8	3	2
Have you ever used a webcam?	Yes	24	10	16
	No	1	0	0
Have you ever used a printer?	Yes	25	10	16
	No	0	0	0
Have you ever used a digital camera?	Yes	25	10	16
	No	0	0	0
Have you ever used a mobile phone?	Yes	25	10	16
	No	0	0	0
Have you ever used a Smartphone?	Yes	25	10	15
	No	0	0	1
Have you ever used a PDA?	Yes	6	2	5
	No	19	8	11
Do you have a camcorder?	Yes	20	6	8
	No	5	3	8
Do you have a scanner?	Yes	20	8	16
	No	5	1	0
Do you have a webcam?	Yes	25	9	16
	No	0	0	0
Do you have a printer?	Yes	24	9	16
	No	1	0	0
Do you have a digital camera?	Yes	23	8	16
	No	2	1	0
Do you have a mobile phone?	Yes	23	8	16
	No	2	1	0
Do you have a Smart phone?	Yes	21	8	12
	No	4	1	4
Do you have a PDA e.g. Palm?	Yes	3	0	1
	No	22	9	15

Table 9.10.1: What technologies do students own and use? (KS3 n = 25, KS4 n = 12 (10 students completed this section but one student missed some questions), KS5 n = 16)

Statement (n = 28)	Population SD	Sample SD	Mean
The website was easy to learn how to use and navigate	0.70	0.71	4.29
I was on task while using the website	0.76	0.77	4.18
The website was easy for the teacher to set up	0.78	0.80	4.25
I found the website instructions clear	0.79	0.81	4.14
I felt I was able to learn from the website	0.80	0.82	3.68
I liked interacting with the activities on the website	0.86	0.88	3.89
I felt motivated whilst using the website	0.90	0.92	3.79
I would visit the website again for revision purposes	1.00	1.02	3.93
The graphics and animations from the website helped me to learn	1.04	1.06	3.32

Table 9.10.2: Year 9 Wikispaces Evaluation Survey Responses - Standard Deviations

Statement (n = 27)	Population SD	Sample SD	Mean
I felt I was able to learn from Kerboodle	0.52	0.53	4.74
I liked interacting with the Kerboodle tools	0.54	0.55	4.67
Kerboodle was easy for the teacher to set up	0.57	0.58	4.56
I felt motivated whilst using Kerboodle	0.57	0.58	4.44
I was on task while using Kerboodle	0.61	0.62	4.33
I found the Kerboodle instructions clear	0.68	0.69	4.59
Kerboodle was easy to learn how to use	0.69	0.70	4.52
The graphics and animations from Kerboodle helped me to learn	0.70	0.71	4.26

Table 9.10.3: Year 9 Kerboodle Evaluation Survey Responses - Standard Deviations

Statement	Population SD	Sample SD	Mean
The graphics and animations from Kerboodle helped me to learn	0.87	0.89	3.56
I liked interacting with the Kerboodle tools	0.95	0.97	3.63
I felt I was able to learn from Kerboodle	0.99	1.01	3.56
Kerboodle was easy to learn how to use	1.02	1.03	3.63
I found the Kerboodle instructions clear	1.05	1.07	3.70
Kerboodle was easy for the teacher to set up	1.15	1.17	3.70
I was on task while using Kerboodle	1.20	1.22	3.22
I felt motivated whilst using Kerboodle	1.20	1.22	2.56

Table 9.10.4: Year 10 Kerboodle Evaluation Survey Responses - Standard Deviations

Statement (n = 17)	Population SD	Sample SD	Mean
The website was easy to learn how to use and navigate	0.70	0.72	4.53
I felt I was able to learn from the website	0.70	0.72	4.47
I was on task while using the website	0.75	0.77	4.29
I felt motivated whilst using the website	0.81	0.83	4.24
The website was easy for the teacher to set up	0.84	0.86	4.35
I liked interacting with the activities on the website	0.88	0.90	4.24
I found the website instructions clear	0.96	0.99	4.12
The graphics and animations from the website helped me to learn	1.26	1.30	3.76

Table 9.10.5: Year 10 Website Evaluation Survey Responses - Standard Deviations

Statement (n = 6)	Population SD	Sample SD	Mean
The blog environment is user-friendly	0.47	0.52	4.33
I like expressing my personal opinion in blogs	0.75	0.82	3.33
Writing blog entries helps me to reflect on my personal life	0.75	0.82	3.33
I like expressing my professional opinion in blogs	0.76	0.84	3.50
Writing blog entries helps me to reflect on my work	0.94	1.03	3.67
I expect other people to post comments on my blog	0.96	1.05	3.50
Blogs are useful for communicating with peers	1.00	1.10	4.00
The process of writing feedback to peers is meaningful	1.11	1.21	3.33
I access others' blogs regularly	1.11	1.21	3.33
Blogs are useful for communicating with teachers	1.12	1.22	3.50
I access my own blog regularly	1.25	1.37	3.33
I respond to posts on my own blog regularly	1.38	1.52	3.50

Table 9.10.6: KS5 Students' Perceptions of Blogs – Standard Deviations

Statement (n = 14)	Population SD	Sample SD	Mean
I would have preferred the wiki to be less public	0.50	0.52	2.50
The text editor on the wiki was more enjoyable to use than MS Word	0.53	0.55	3.00
I was comfortable with the degree of publicity of the wiki	0.61	0.63	4.36
It was easy to use the wiki after being shown how to use it	0.62	0.65	4.57
I felt that others will learn by using the wiki	0.70	0.73	3.93
It was effective to use the wiki in group work	0.77	0.80	3.79
I liked commenting on others' work	0.77	0.80	3.21
I liked editing others' work	0.77	0.80	3.21
The wiki helped in producing good quality work	0.80	0.83	3.29
The wiki was effective in supporting engagement with course content	0.80	0.83	3.29
I felt that I learned something by using the wiki	0.81	0.84	3.64
The wiki was effective in supporting learning	0.82	0.85	3.43
I liked that others could comment on my work	0.83	0.86	3.14
The wiki motivated me to collaborate with others in the group	0.83	0.86	3.14
The wiki made collaboration with others easier	0.84	0.88	3.29
It was easy to use the wiki initially	0.85	0.88	4.00
The text editor on the wiki was easier to use than MS Word	0.85	0.88	3.00
The quality of collaboration in the group increased with the use of the wiki	0.85	0.88	3.00
There were no technology based issues with the wiki	0.88	0.92	4.07
I liked that others could edit my work	0.95	0.99	2.93

Table 9.10.7: KS5 Students' Perceptions of Wikis – Standard Deviations

Statement (n = 16)	Population SD	Sample SD	Mean
I downloaded past papers from the course website	0.39	0.40	4.81
I downloaded markschemes from the course website	0.39	0.40	4.81
I think that downloading past papers/markschemes will improve my grade	0.39	0.40	4.81
Overall I was satisfied with the course website	0.43	0.45	4.75
I found the course website to be a helpful resource	0.61	0.63	4.56
I believe that course websites enhance learning	0.63	0.66	4.19
I liked that I received an instant grade after taking an online quiz	0.68	0.70	3.69
I was satisfied with the content available on the course website	0.70	0.72	4.06
The lecture notes were easy to print	0.73	0.75	4.19
I think that reading/using the lecture notes will improve my grade	0.78	0.81	4.13
I find taking tests online convenient	0.78	0.81	4.13
The quiz worked during my visit	0.79	0.81	3.56
I found the online scheme of work to be a valuable resource	0.79	0.82	3.50
I found the online lecture notes to be a valuable resource	0.83	0.86	4.25
I think that completing the online quizzes will improve my grade	0.83	0.85	3.94
I think that using the online scheme of work will improve my grade	0.83	0.86	3.75
I would like to be able to contribute to the course website	0.83	0.86	2.75
The course website is a good place for the instructor to place handouts	0.86	0.89	4.13
I regularly visited the online scheme of work	0.86	0.89	3.44
Course websites extend personal interactions	0.86	0.89	2.63
I think that reading/using the online specification will improve my grade	0.87	0.89	3.50
I think that using the course website will improve my grade	0.88	0.91	3.81
The course website increased interactions with other students in the group	0.92	0.95	3.31
I found the online quizzes to be a valuable resource	0.93	0.96	3.63
The course website increased my interactions with the teacher	0.93	0.96	3.44
I received a reply within 24 hours	0.93	0.96	3.44
I found the links contained on the course website to be valuable	0.94	0.97	4.00
The course website helped to create a sense of community	0.95	0.98	2.81
I regularly visited the online specification	0.98	1.01	3.31
I regularly visited the links contained on the course website	0.99	1.02	4.13
I used the course website to help me to understand course information	1.01	1.05	3.81
I believe that course websites will play an important part in education in future	1.01	1.05	3.81
I found the online specification to be a valuable resource	1.04	1.08	3.69
I would prefer a paper copy of the handouts	1.06	1.10	3.50
I think the email system will improve my grade	1.06	1.10	3.50
I regularly completed the online quizzes	1.12	1.15	3.50
I regularly checked my email inbox for messages from the teacher	1.12	1.15	3.00
I emailed the teacher using the 24 hour reply system	1.13	1.17	2.81
I would like to see course websites added to all of my courses	1.17	1.21	3.44
I regularly used the course website to answer my questions	1.21	1.25	3.31

Table 9.10.8: KS5 Students' Perceptions of Course Websites – Standard Deviations

Statement (n = 15)	Population SD	Sample SD	Mean
I had no technical issues when making the website	0.54	0.56	3.80
I think making the website was detrimental to my learning	0.60	0.62	1.67
I think that making the website wasted my time	0.63	0.65	2.00
I think that the ICT skills I used when making the website will be useful in the future	0.68	0.70	3.27
I found adding music to the website was easy to do	0.71	0.74	2.60
I added diagrams and/or pictures to my website	0.72	0.74	4.13
Overall I was satisfied with the website I made	0.72	0.74	3.53
I believe that revision websites will play an important part in education in the future	0.72	0.74	3.53
I think other students will find my website to be a valuable resource	0.72	0.74	3.53
I learnt new ICT skills when making the website	0.73	0.76	3.00
I found adding pictures and diagrams to the website was easy to do	0.75	0.77	4.20
I was satisfied with the other features I could add to my website	0.77	0.80	3.73
I think that completing my online quizzes will improve others' learning	0.77	0.80	3.27
I believe that revision websites enhance learning	0.80	0.83	3.40
The quiz or game software worked and was easy to use	0.80	0.83	3.40
I was satisfied with the tools available on the Yola website	0.81	0.83	3.87
I found making the website to be helpful for revision	0.81	0.83	3.53
I regularly visited my website throughout the course	0.81	0.83	2.87
I added links to my website	0.85	0.88	3.93
I regularly updated my website throughout the course	0.85	0.88	2.73
I think that making the revision website will improve my grade	0.87	0.90	3.67
I added music to my website	0.88	0.92	2.53
The revision website exercise helped to create a sense of community	0.91	0.94	3.20
I think that online quizzes improve enjoyment of websites	0.93	0.96	3.93
I used the instructions to help me to understand how to make my website	0.93	0.96	3.73
The revision website increased my interactions with the other students in the group	0.93	0.96	2.80
I was comfortable with the level of publicity of my website	0.95	0.99	3.60
The instructions were easy to understand	0.96	0.99	3.87
I would like to make websites for all of my subjects	0.97	1.00	3.00
I added online quizzes or games to my website	1.07	1.11	3.33
I would have rather completed a different activity in the class time spent making the websites	1.08	1.12	2.60

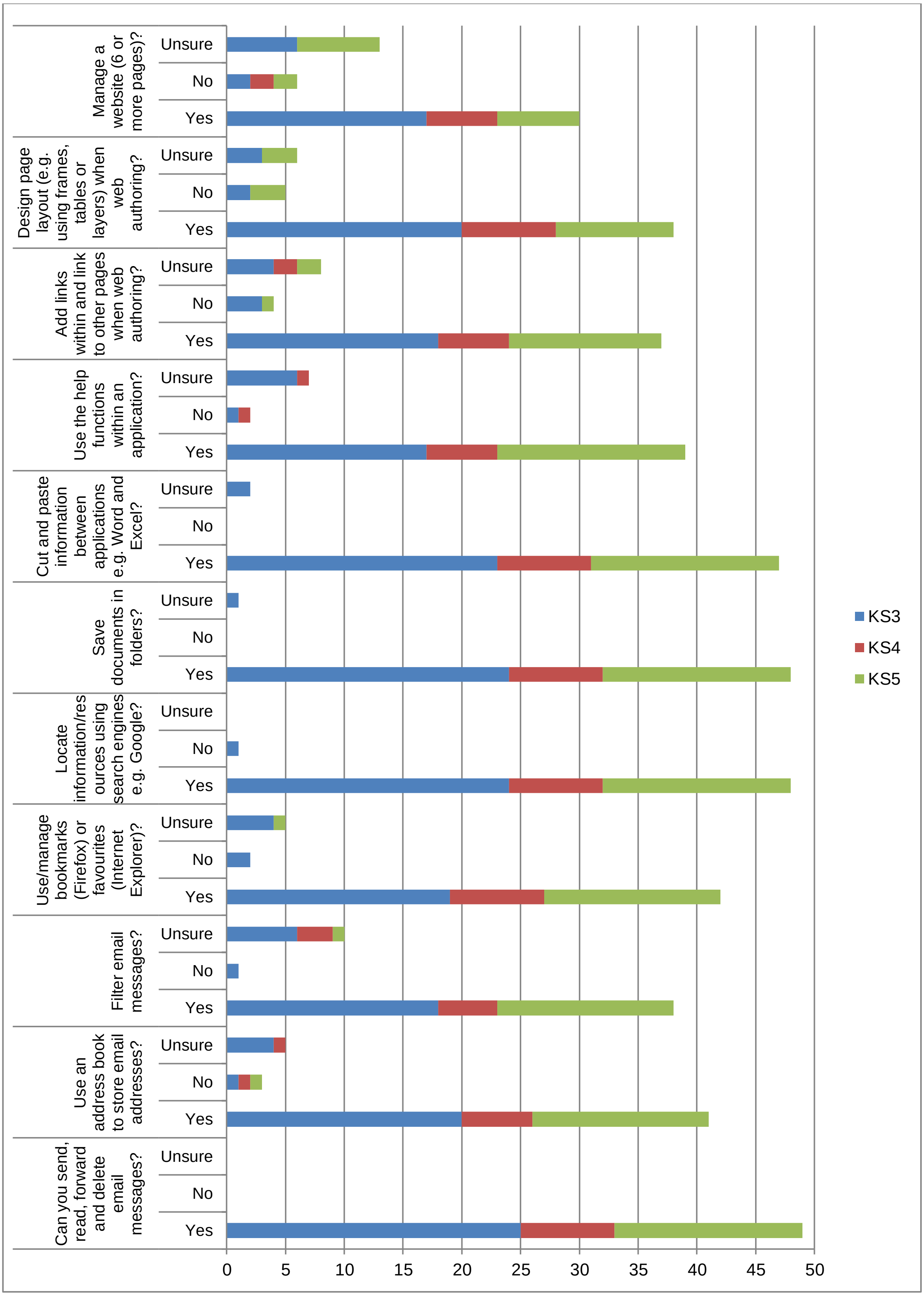
Table 9.10.9: KS5 Students' Perceptions of Making Websites – Standard Deviations

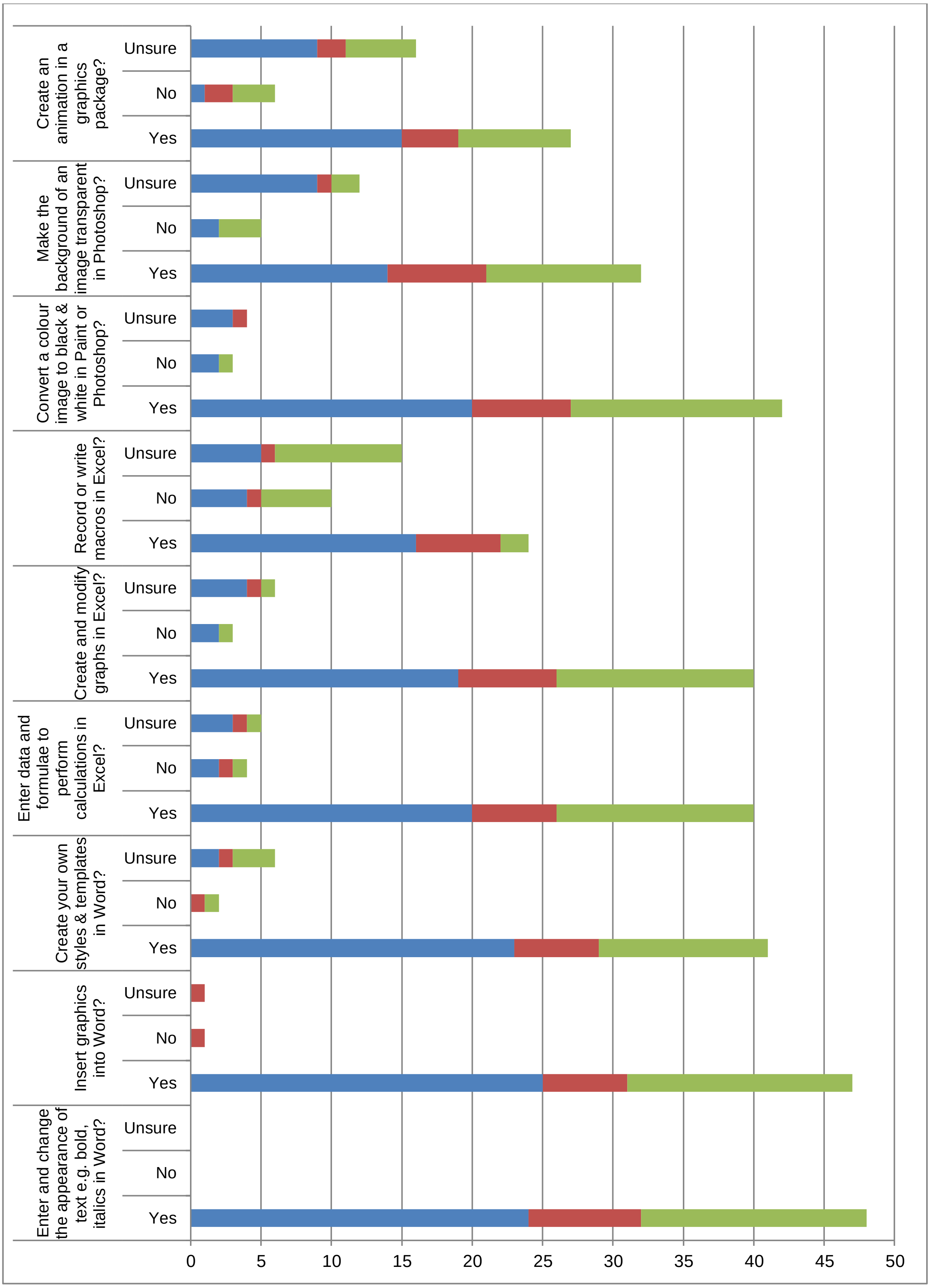
Statement (n = 16)	Population SD	Sample SD	Mean
Web tools allow learners to pose questions to the community.	0.63	0.66	4.19
Web tools allow learners and/or teachers to find and share educational resources.	0.70	0.72	4.38
Web tools allow learners and/or teachers to share photos, music and videos.	0.73	0.75	4.19
Web tools help learners to develop communication and language skills	0.79	0.82	4.00
Web tools allow learners to work through their ideas and promote critical reflection.	0.79	0.82	4.00
Web tools provide collaborative learning opportunities.	0.83	0.86	4.25
Web tools appeal to digital native learners.	0.83	0.85	4.06
Web tools bring learners' work to an authentic and wider audience.	0.83	0.85	3.94
Web tools promote learners to interact and build a learning community.	0.83	0.85	3.94
Web tools allow learners to connect content, people, ideas and conversations.	0.85	0.87	3.69
Web tools allow learners and/or teachers to hold forums to discuss topics of interest.	0.86	0.89	3.88
Web tools facilitate communication and feedback between learners and teachers.	0.87	0.89	4.00
Web tools allow learners to become content producers and not just receivers.	0.90	0.93	4.06
Web tools develop skills needed in today's modern technological world.	0.98	1.01	4.31
Web tools help learners to develop a sense of ownership.	1.00	1.03	3.56
Web tools allow learners to express individuality and creativity.	1.01	1.05	4.19
Web tools encourage learners to add value to the applications as they use it.	1.04	1.08	3.69
Web tools promote knowledge sharing.	1.05	1.09	4.13
Web tools open classroom walls.	1.06	1.10	4.00
Web tools allow learners to share their opinions, experiences and perspectives.	1.07	1.11	4.19

Table 9.10.10: KS5 Students' Perceptions of Webtools – Standard Deviations

Statement (n = 11)	Population SD	Sample SD	mean n=11
The website was easy to use	0.45	0.47	4.73
I learnt new things by doing the bridging project	0.48	0.50	4.64
I refreshed my memory of science subjects by doing the bridging project	0.64	0.67	4.36
The bridging projects were easy to download	0.66	0.69	4.55
I would recommend that other students complete a bridging project prior to starting their AS courses	0.66	0.69	4.55
I found the bridging project interesting	0.67	0.70	3.91
Completing the bridging project has improved confidence in my subjects	0.72	0.75	3.82
The bridging projects were easy to access	0.78	0.82	4.45
I enjoyed completing the bridging project	0.78	0.82	3.45
I could get help with the bridging project when I needed it	0.89	0.93	3.55
Completing the bridging project has helped me have a good start to my AS courses	0.90	0.94	3.91
I would have preferred a forum so I could discuss answers with others	0.94	0.98	2.82
I would have preferred a paper copy of the bridging project	1.44	1.51	3.45

Table 9.10.11: KS5 Students' Bridging Project Survey Responses - Standard Deviations


Can you send, read, forward and delete email messages?
Use an address book to store email addresses?
Filter email messages?
Use/manage bookmarks (Firefox) or favourites (Internet Explorer)?
Locate information/resources using search engines e.g. Google?
Save documents in folders?
Cut and paste information between applications e.g. Word and Excel?
Use the help functions within an application?
Add links within and link to other pages when web authoring?
Design page layout (e.g. using frames, tables or layers) when web authoring?
Manage a website (6 or more pages)?
Yes
No
Unsure
0
5
10
15
20
25
30
35
40
45
50
KS3
KS4
KS5



Figures 9.10.2 and 9.10.3: Students' perceptions of their specific ICT skills Blue = 9M Red = 10x2 Green = KS5

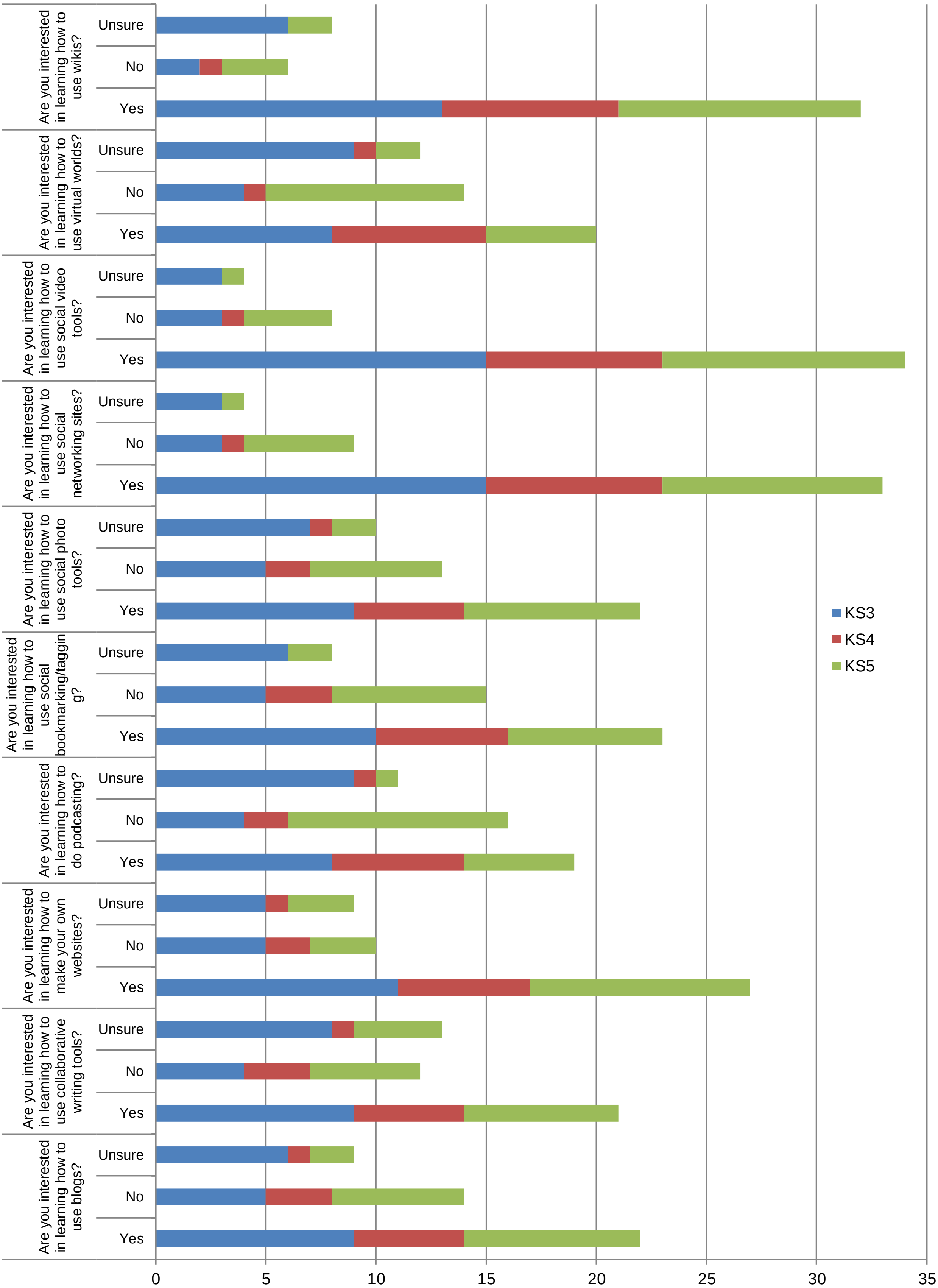


Figure 9.10.4: Webtools that students want to learn how to use

	KS3	KS4	KS5
Have used a camcorder	92	100	94
Have used a scanner	68	70	88
Have used a webcam	96	100	100
Have used a printer	100	100	100
Have used a digital camera	100	100	100
Have used a mobile phone	100	100	100
Have used a Smartphone	100	100	94
Have used a PDA	24	20	31
Owns a camcorder	80	67	50
Owns a scanner	80	89	100
Owns a webcam	100	100	100
Owns a printer	96	100	100
Owns a digital camera	92	89	100
Owns a mobile phone	92	89	100
Owns a Smart phone	84	89	75
Owns a PDA e.g. Palm	12	0	6

Table 9.10.12: What technologies do students own and use?

(% of students in each focus group)

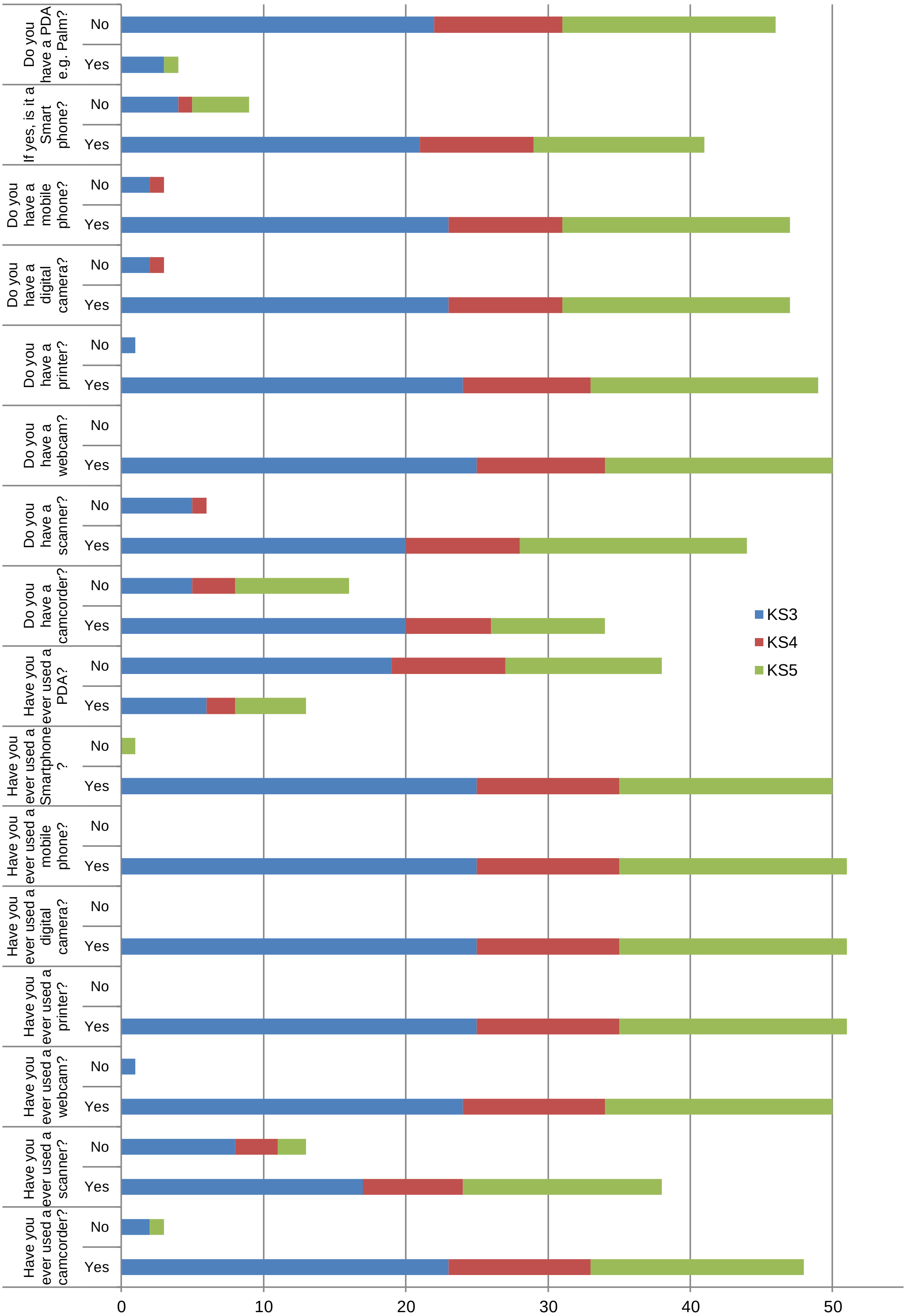


Figure 9.10.5: Which technologies do students own and use?

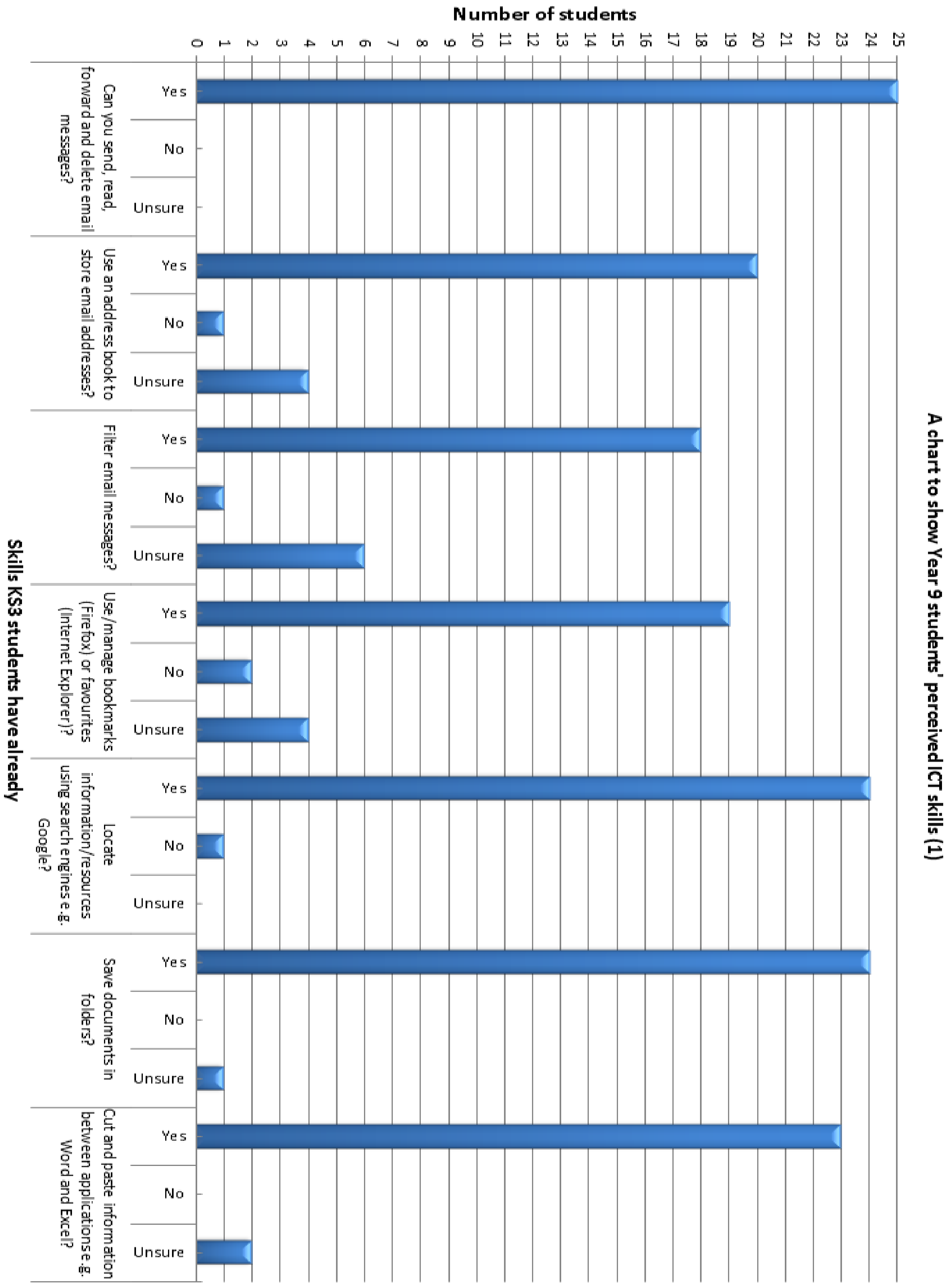


Figure 9.10.6: KS3 (Focus group A) students' perceptions of their current ICT skills (1) (n = 25)

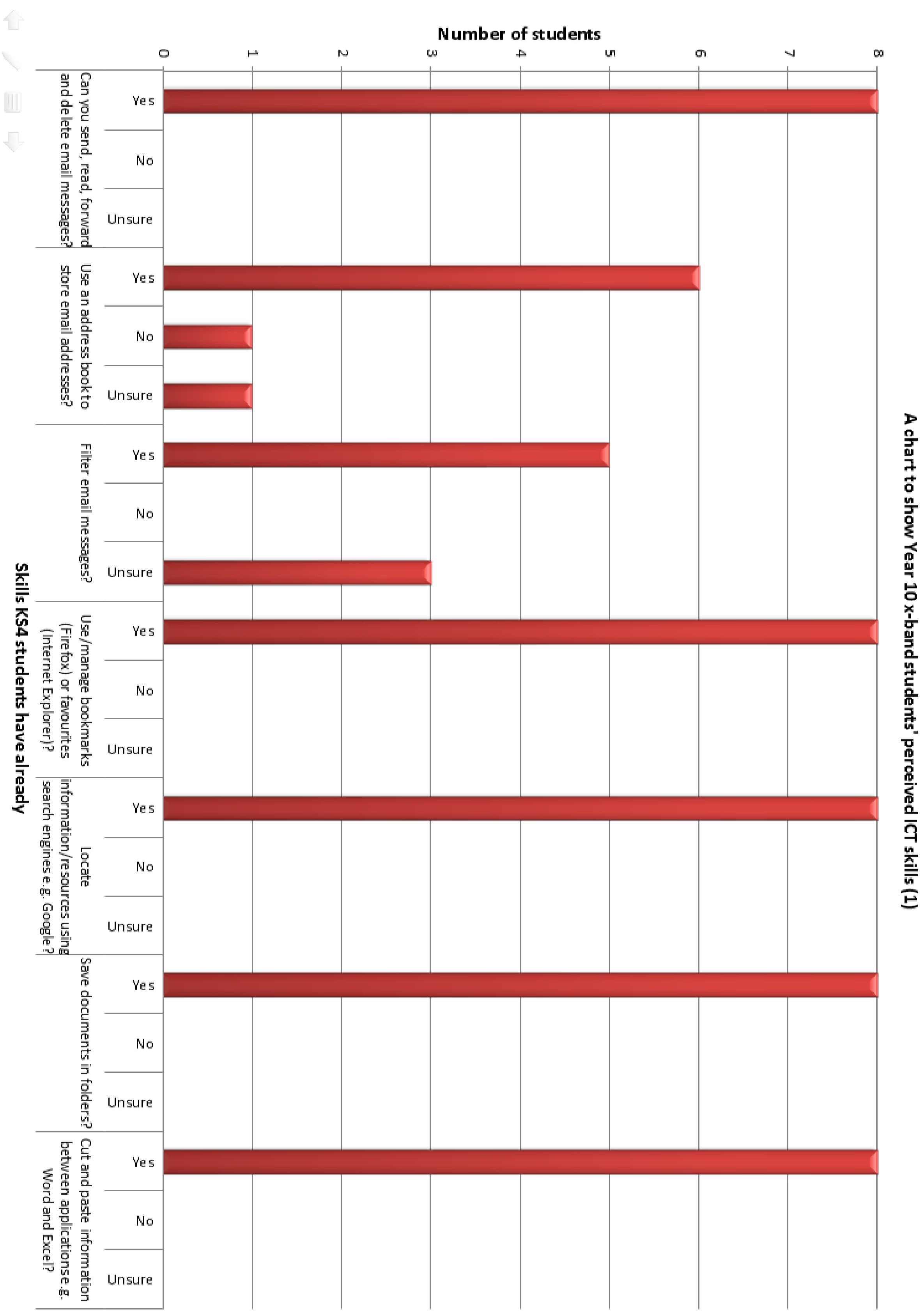


Figure 9.10.7: KS4 (Focus group B) students' perceptions of their current ICT skills (1) (n = 8)

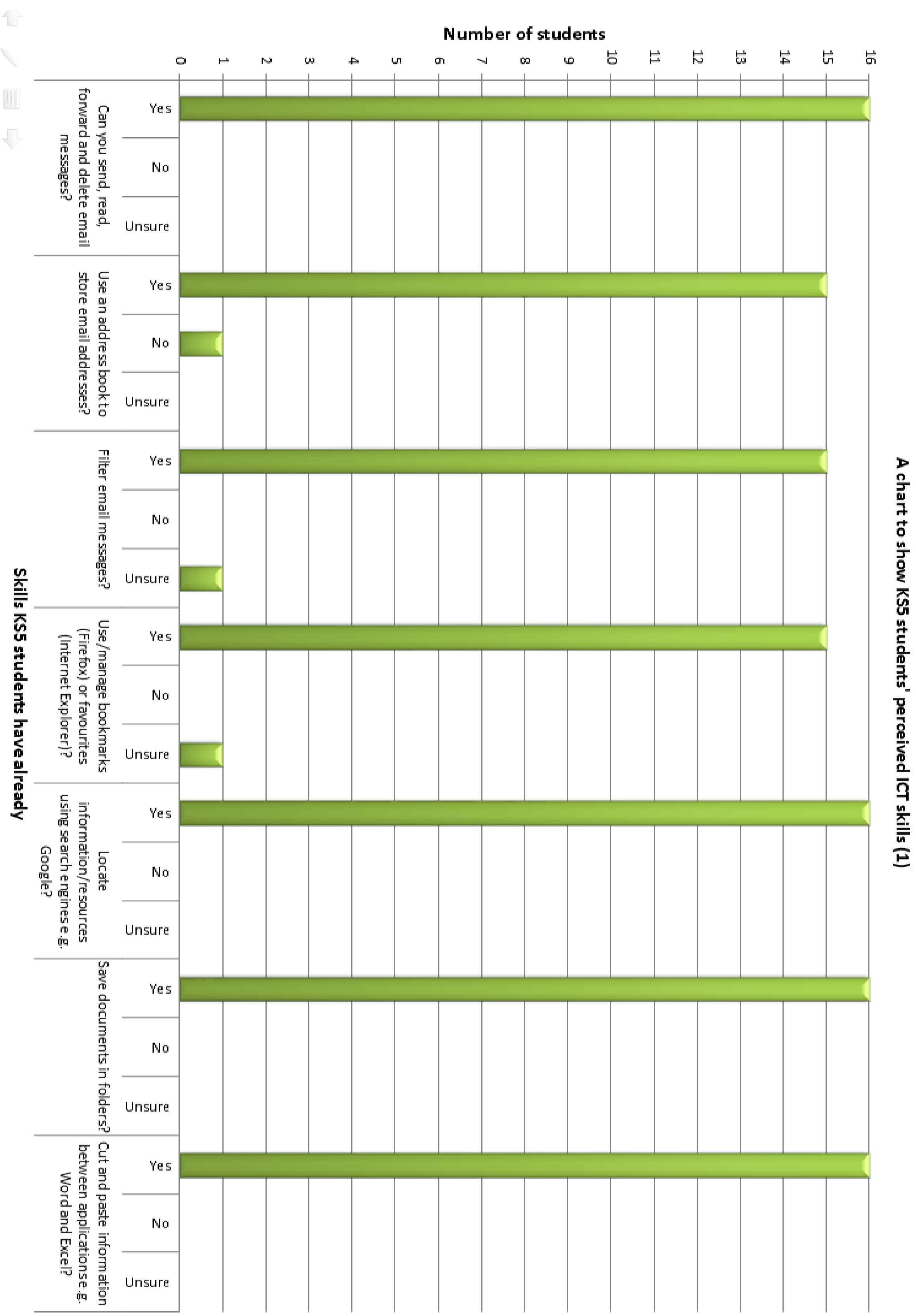


Figure 9.10.8: KS5 (Focus group D) students' perceptions of their current ICT skills (1) (n = 16)

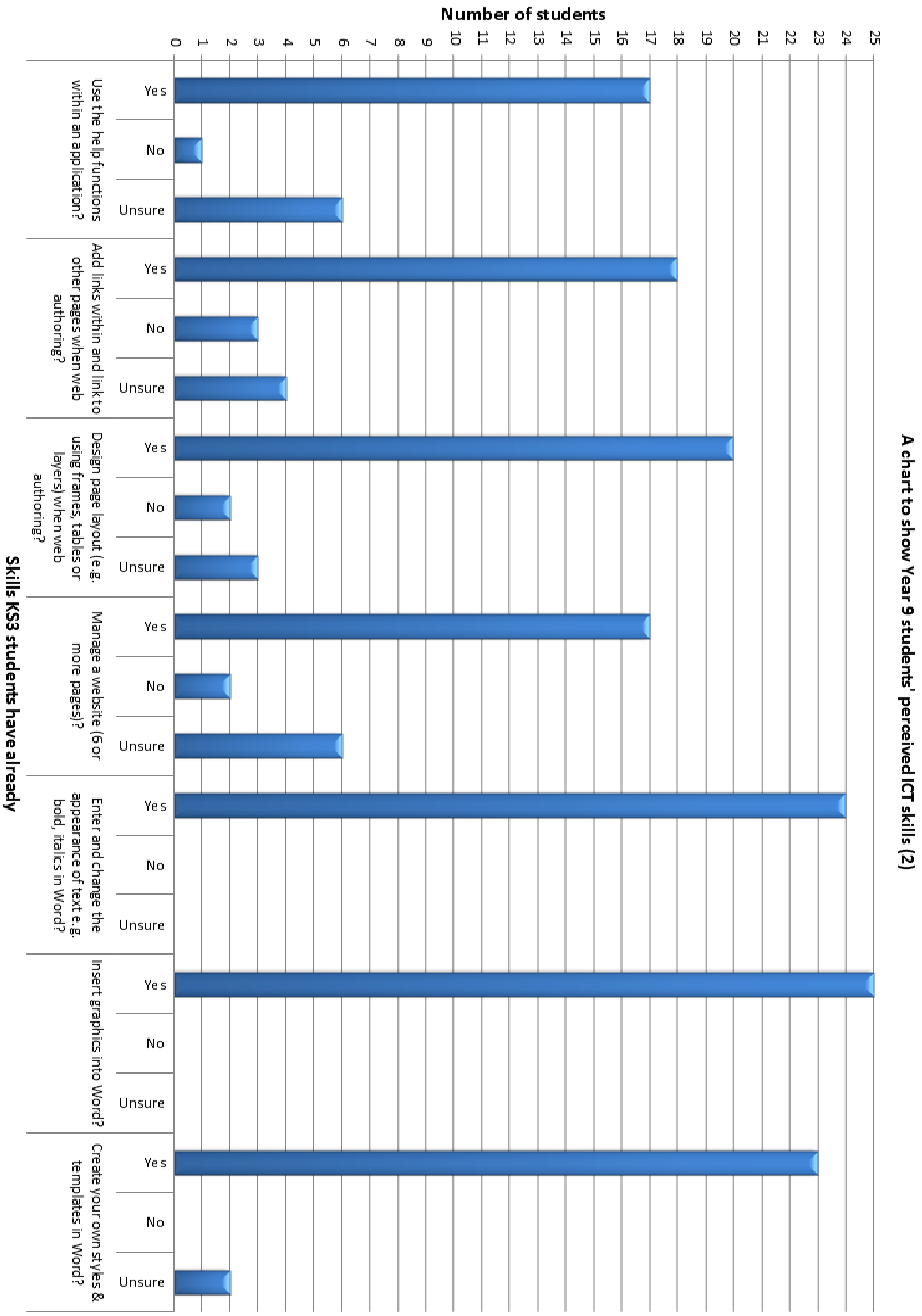


Figure 9.10.9: KS3 (Focus group A) students' perceptions of their current ICT skills (2) (n = 25)

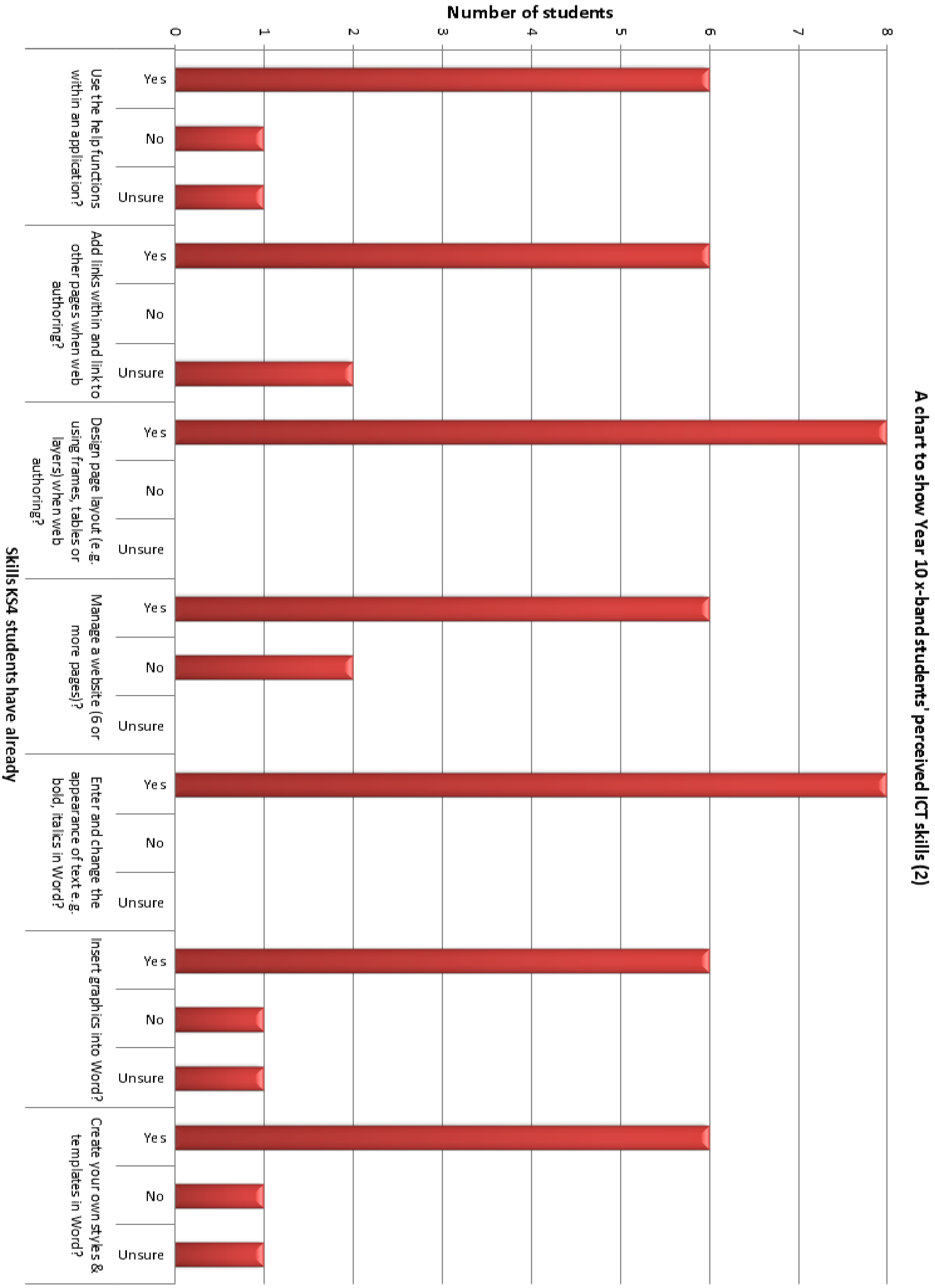


Figure 9.10.10: KS4 (Focus group B) students' perceptions of their current ICT skills (2) (n = 8)

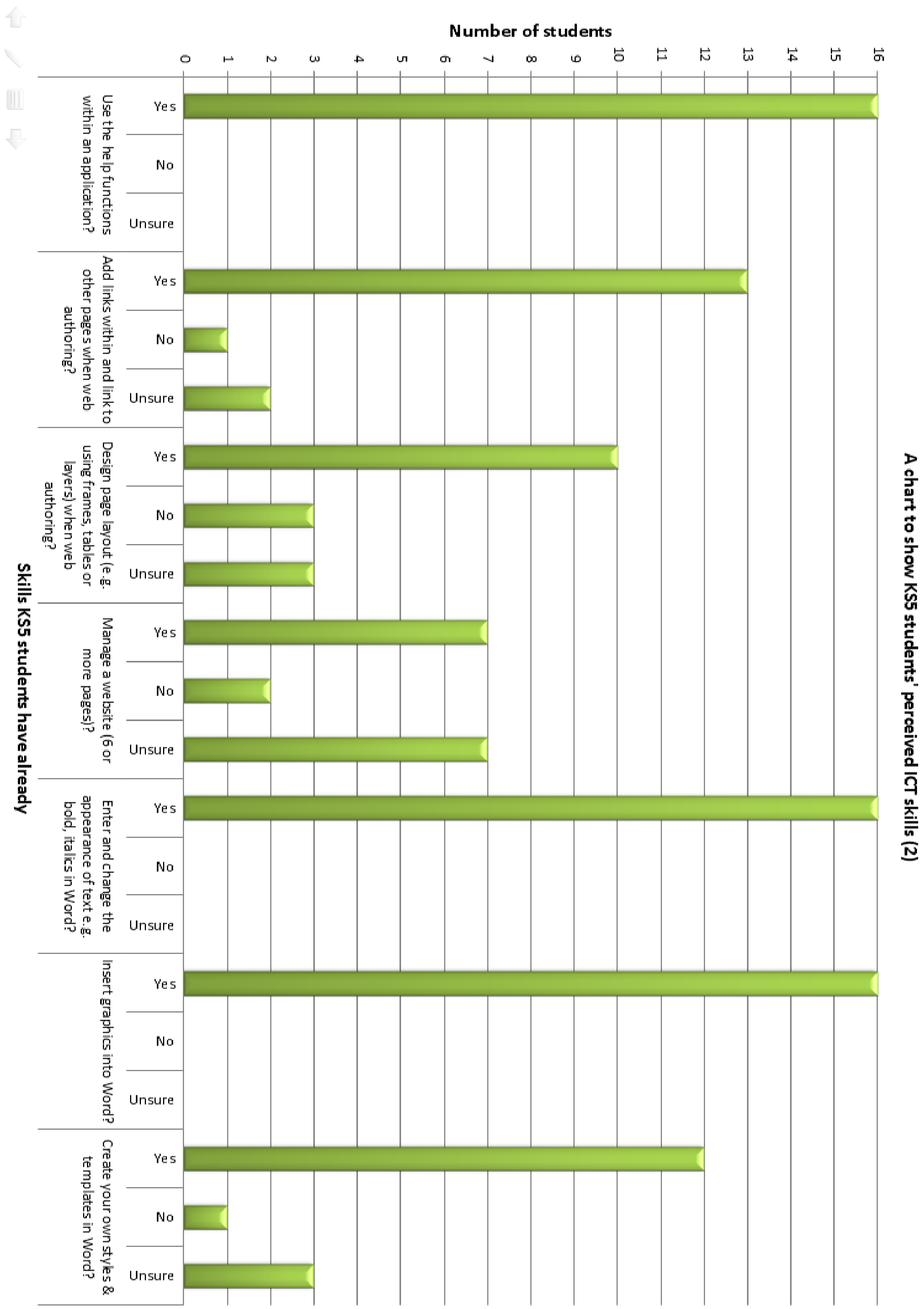


Figure 9.10.11: KS5 (Focus group D) students' perceptions of their current ICT skills (2) (n = 16)

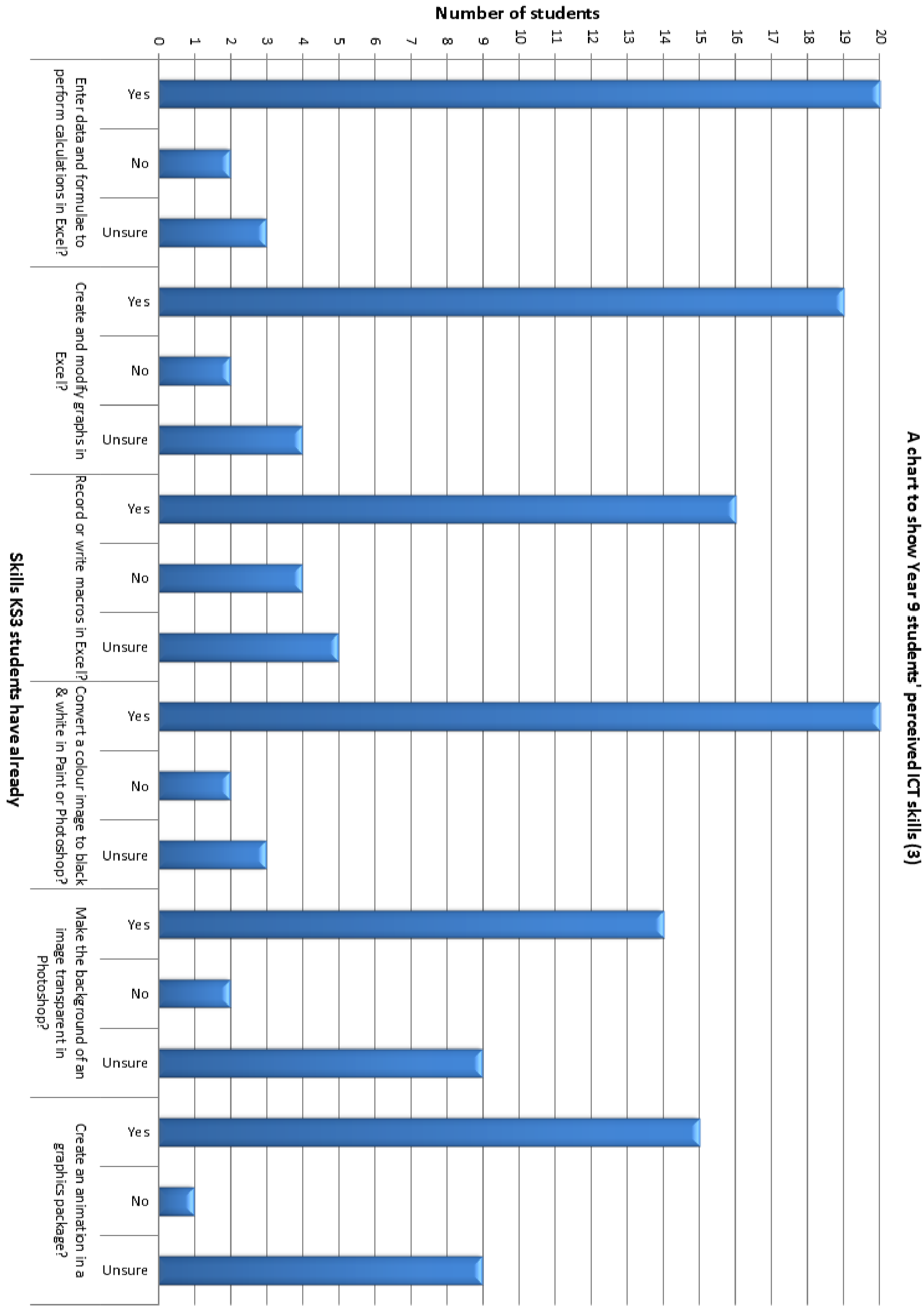


Figure 9.10.12: KS3 (Focus group A) students' perceptions of their current ICT skills (3) (n = 25)

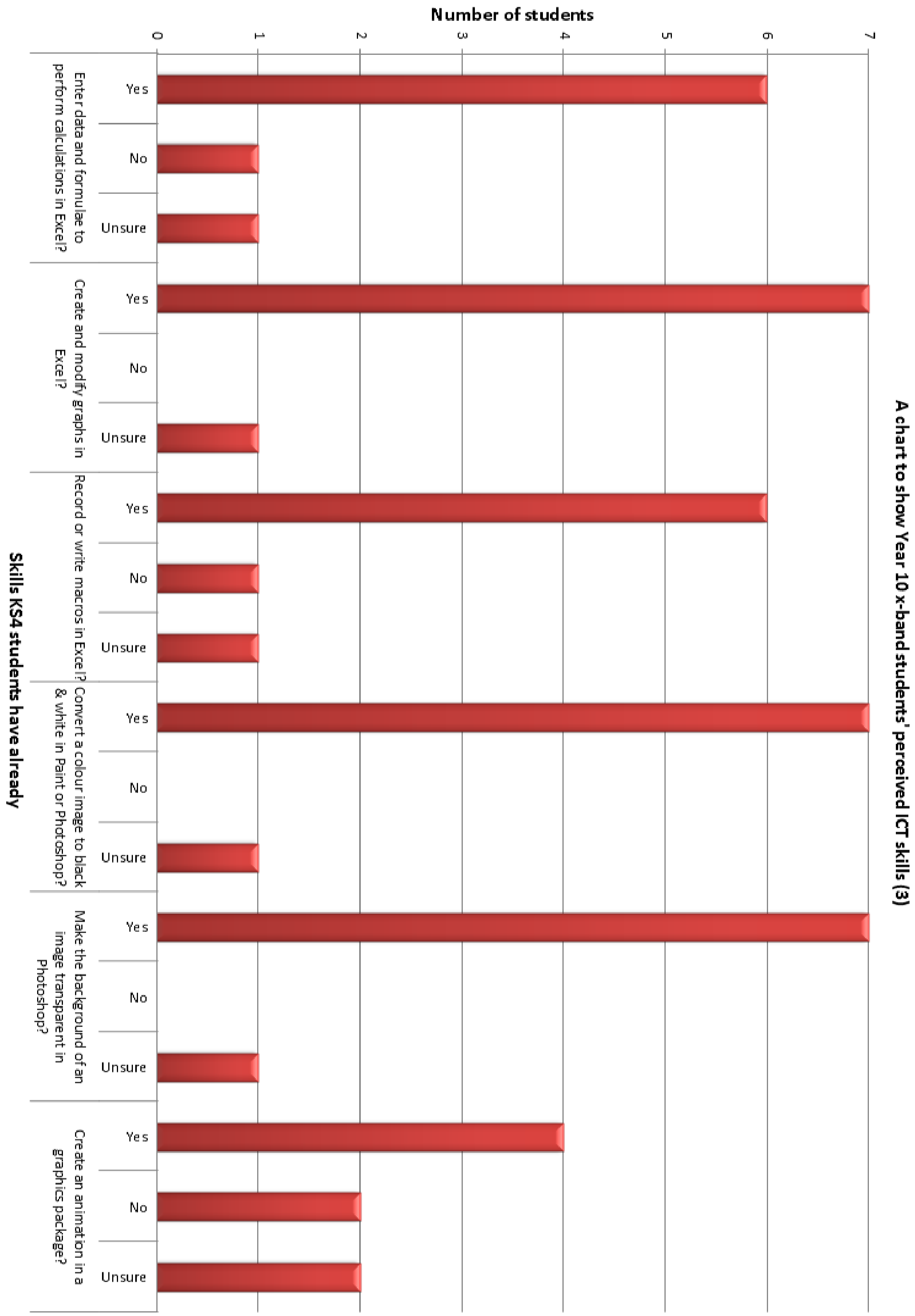


Figure 9.10.13: KS4 (Focus group B) students' perceptions of their current ICT skills (3) (n = 8)

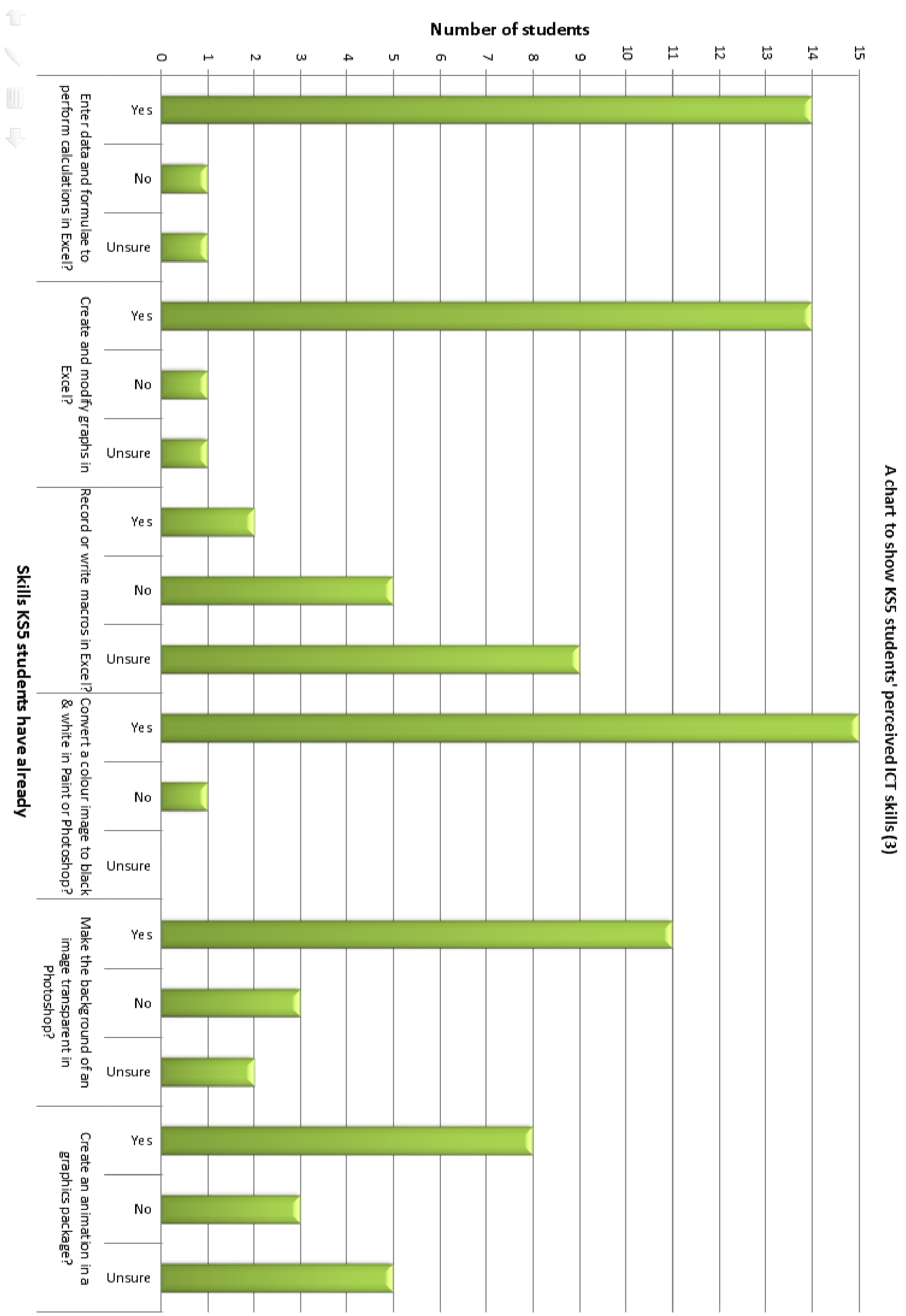


Figure 9.10.14: KS5 (Focus group D) students' perceptions of their current ICT skills (3) (n = 16)

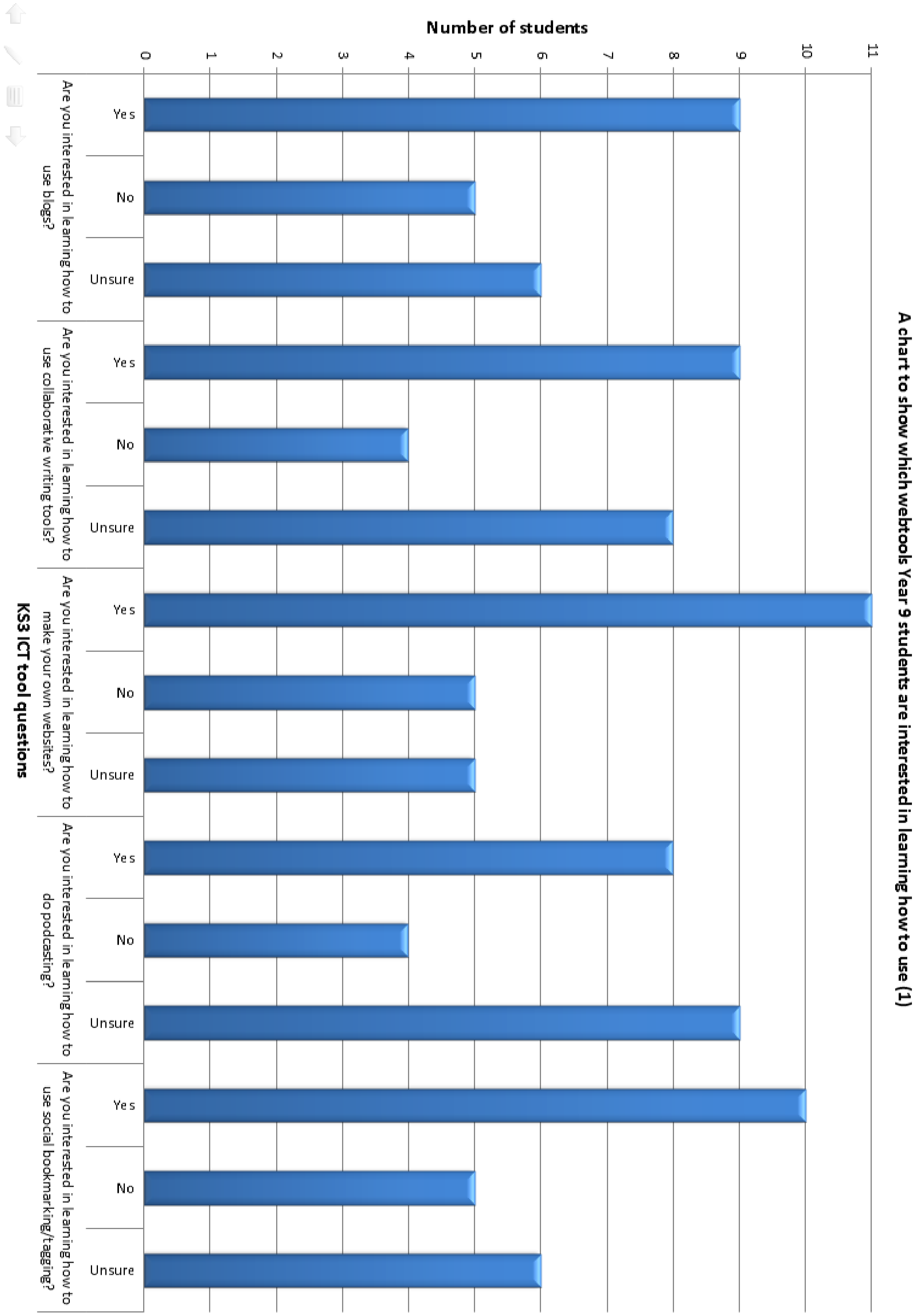


Figure 9.10.15: Which webtools are KS3 (Focus group A) students interested in learning how to use? (1) (n = 21)

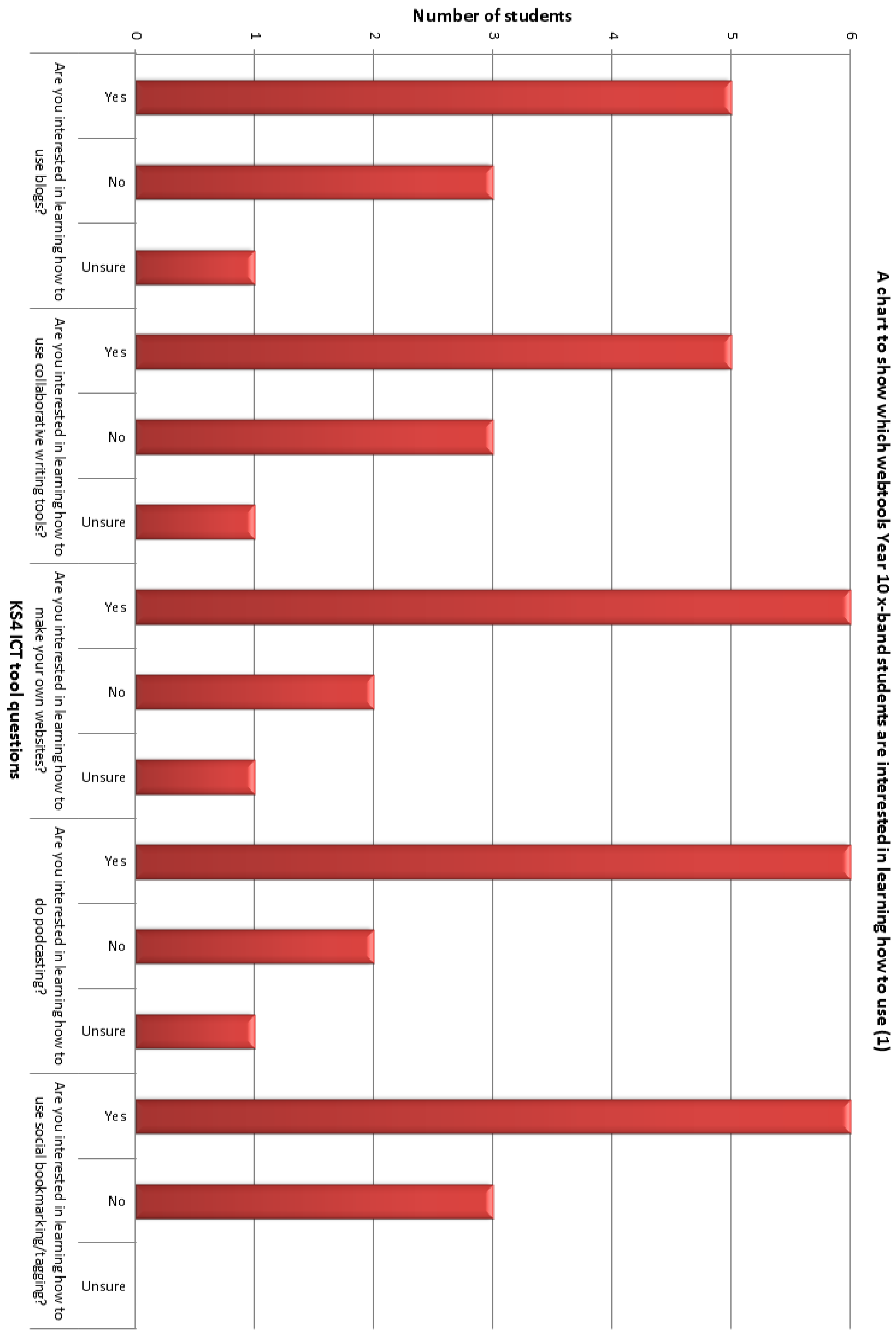


Figure 9.10.16: Which webtools are KS4 (Focus group B) students interested in learning how to use? (1) (n = 9)

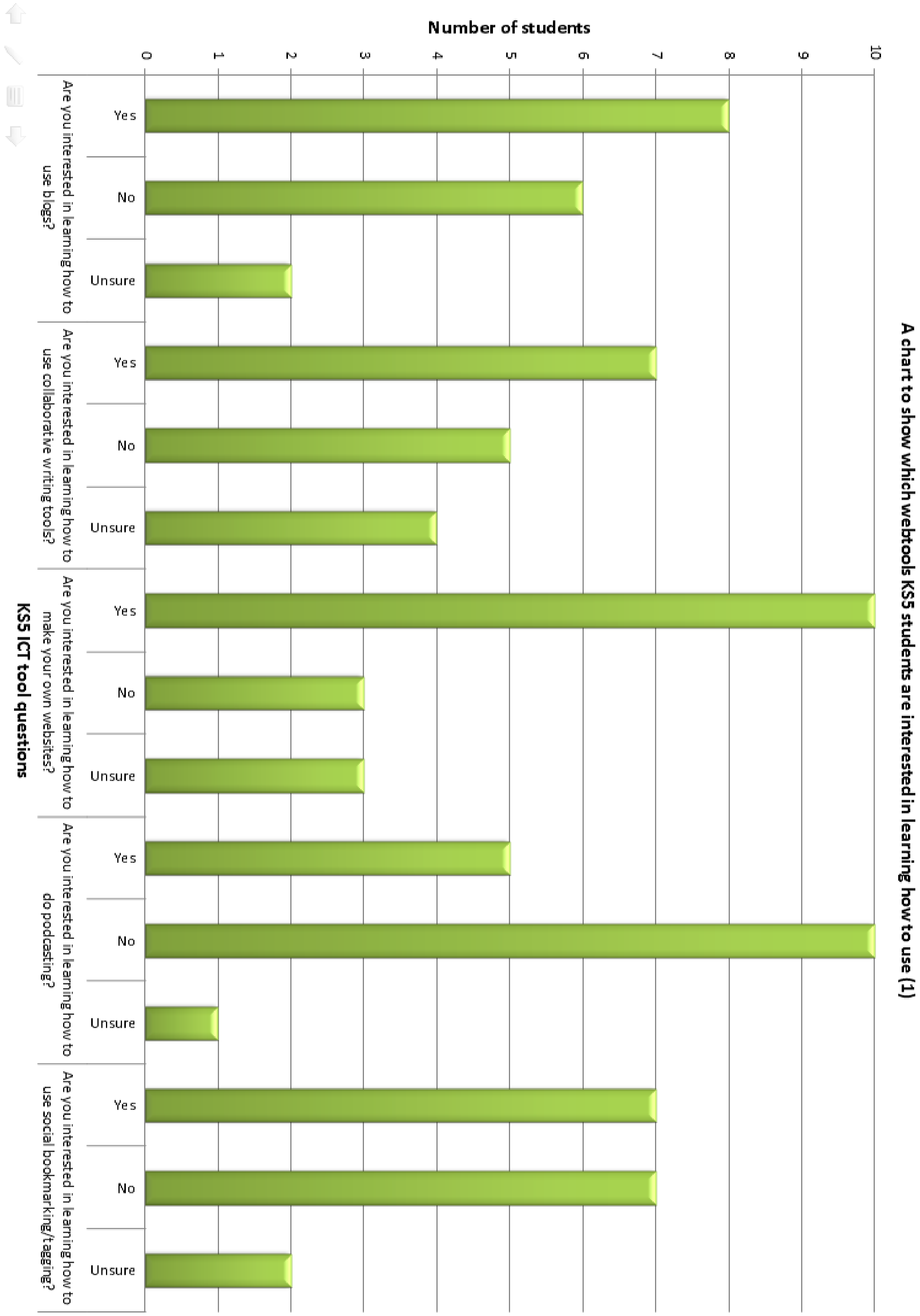


Figure 9.10.17: Which webtools are KS5 (Focus group D) students interested in learning how to use? (1) (n = 16)

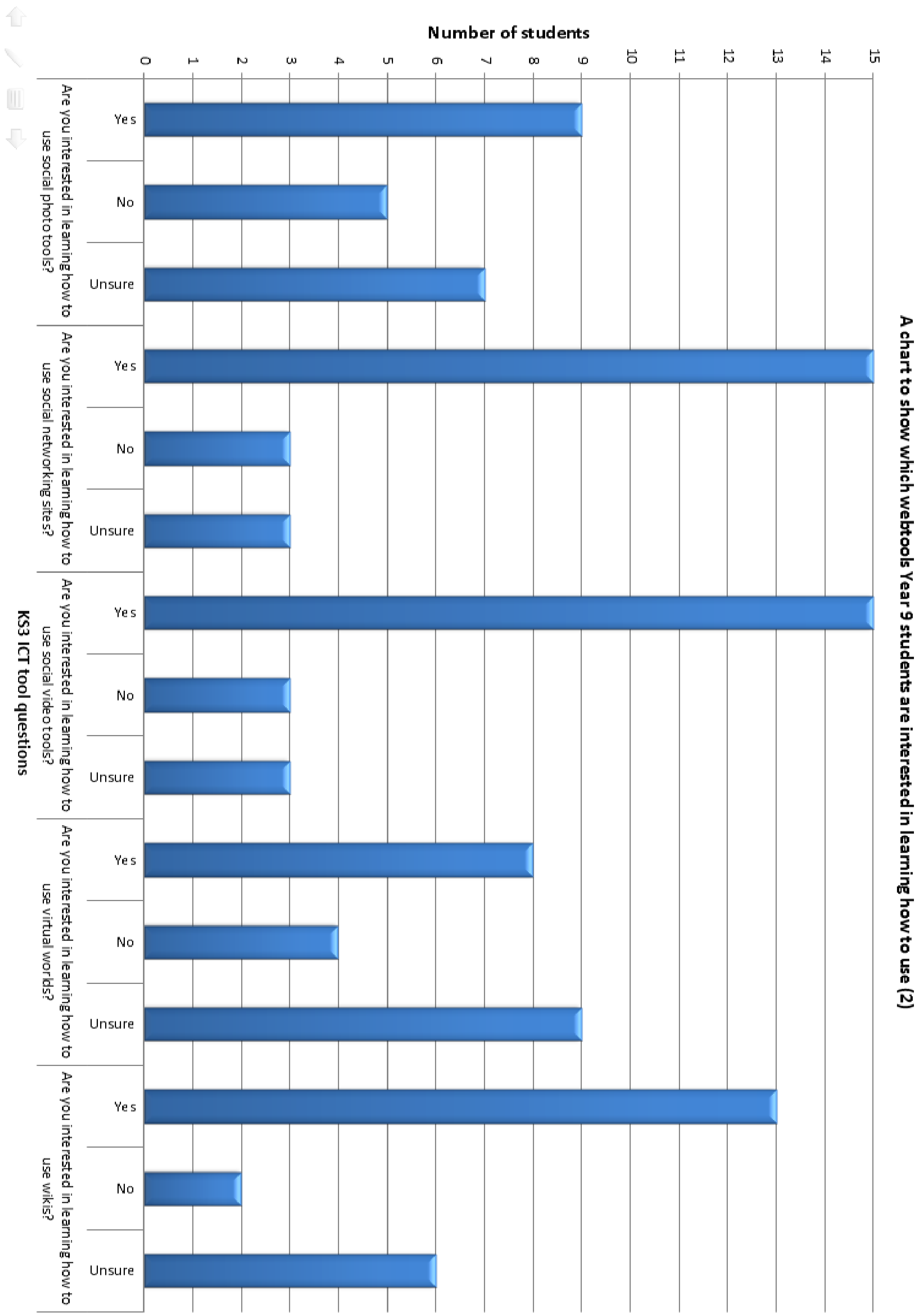


Figure 9.10.18: Which webtools are KS3 (Focus group A) students interested in learning how to use? (2) (n = 21)

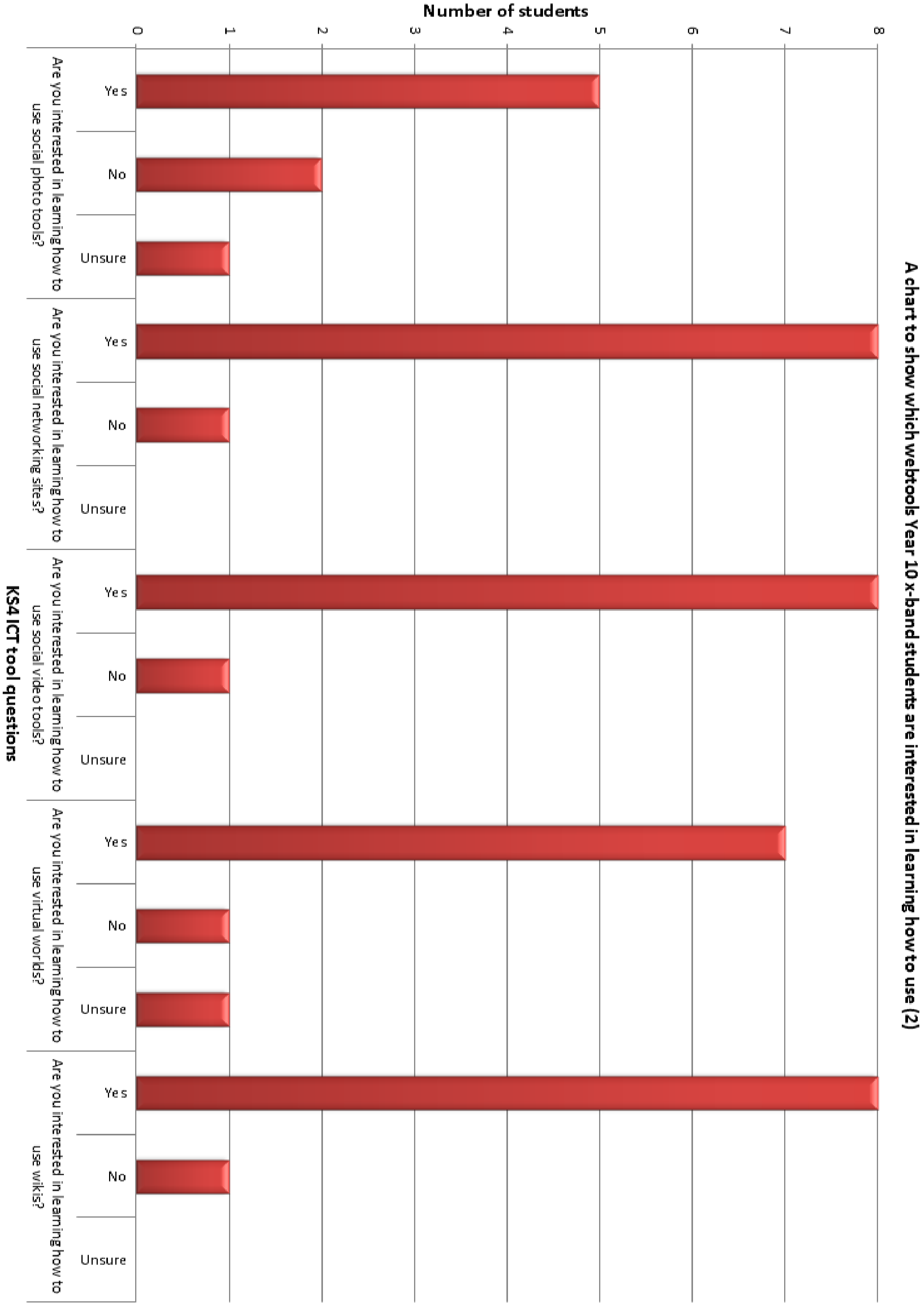


Figure 9.10.19: Which webtools are KS4 (Focus group B) students interested in learning how to use? (2) (n = 9)

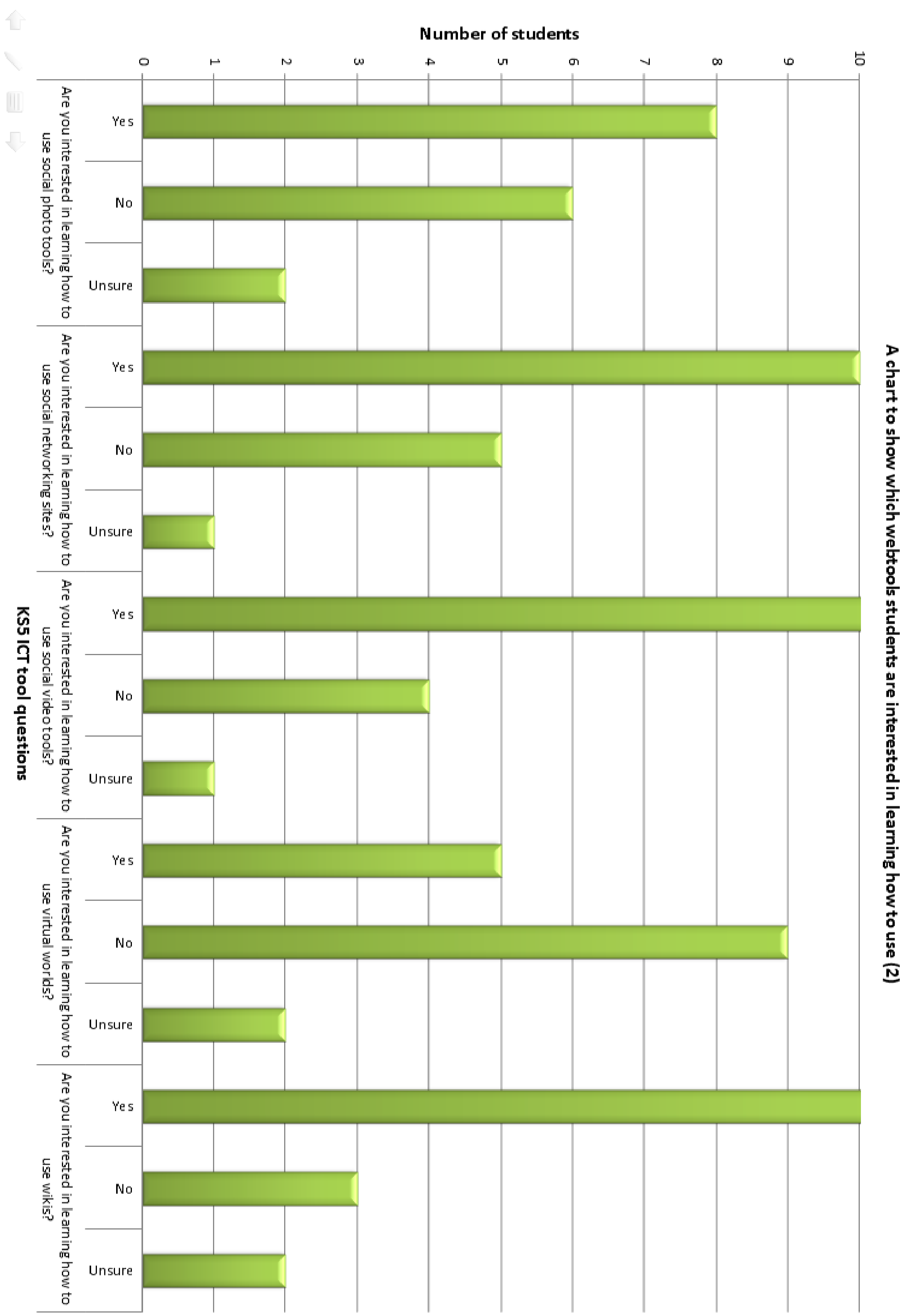


Figure 9.10.20: Which webtools are KS5 (Focus group D) students interested in learning how to use? (2) (n = 16)

APPENDIX 11: INTERVIEW QUESTIONS

Small group interview with 5 Year 13 students who had participated in the study (Focus Group D)

Interviewer: Thank you for taking part in this interview. There are no right or wrong answers so please feel free to answer honestly with your true opinions, and feel free to say as much or little as you wish or not contribute at all if you wish. Do you enjoy using ICT to help your learning?

KH: Yes, and if I hadn't done the site I would still have pursued further IT skills.

SN: Personally, I don't enjoy using ICT… I don't feel it's my best way of learning and I didn't make much progress on the website because I didn't find enough time for it.

CT: Doing this definitely made me explore ICT and influenced me to use ICT at home for revision.

KH: Yeah, it helped me to brush up on my IT skills too - useful in the future.

(General assent at this point; students nodding.)

Interviewer: Do you think making the websites helped you to learn?

CT: Yes! It is a novel way of revising. (Student smiled.)

KH: Yeah, making the websites was helpful with my learning and revision of all the key topics in Chemistry. It also allowed me to be very versatile with what I could look through…and it inspired me to read deeper into the areas I was studying.

AS: I thought that making the website was sort of helpful, but not entirely. I found that writing the information helped me to understand the material better; however, (student paused), I haven't looked at the website since.

MW: It was useful as a method for rewriting notes, so a good revision tool for myself.

SN: I learnt about making websites and yes, it was useful for revision.

Interviewer: Why do you think making the websites helped you, or didn't help you, to learn?

CT: It enabled me to revise with a new tool, not just the usual note-taking and it helped me revise at home.

KH: Yes, and because I felt I was teaching someone else I felt I had to fully understand the content. That was helpful. It cemented it in my head.

AS: Making the website involved self-learning and I had to understand the material first so other people can understand what I'm on about. I think that is one of the positive things about it.

MW: It's probably not as useful to actually teach a subject, but it is a good way of building on knowledge you've already learnt…and it improves your skills in being concise and rephrasing scientific principles in "layman's terms". (Student indicated "" with fingers).

SN: But in uploading my own notes, there's a chance that something has been missed out from the specification. I agree though, it was beneficial for many people if they found the opportunity to share their ideas.

Interviewer: Some people said that they didn't go back to their site again. Did you revisit your site? Why or why not?

KH: I have revisited my site and I have updated it throughout the year and I've even made other websites unrelated to my course because I enjoyed and I felt that I benefitted from it.

AS: I haven't gone back to it because I found I didn't have much time to add to it and also I found it didn't help me to refresh and relearn the material once I'd forgotten some of the material. If it helps other students then great, but I found going back to the website and learning from it wasn't very good.

SN: Yeah, I think that more regular updates were needed.

MW: Even so, it's still good for revision notes for others who view the sites.

Interviewer: What did you think about the 'Yola' website builder and 'Wikispaces' wiki builder?

MW: I think the software would be easy to use for those who are not highly skilled in IT but for those who are more skilled the tools seemed a little simple.

AS: Yes, Yola was simple and easy to use so it made the making of the website enjoyable. The wiki was hard to use at first but after using this software for a while it improved my ICT skills, but after spending some time doing the website I kind of got bored with it, hence why I didn't go back to it.

SN: It was time consuming as I had to learn how to use the sites.

CT: I agree, it was time consuming in terms of setting up the website but it was quick in terms of filling the website with content. I didn't like the wiki for lab writing though. It was complicated and not easy to access.

Interviewer: What do you think about course websites? Would you want to participate in the making of a course website or should the teacher make the site themselves?

KH: I think a course website should be mainly made by the teacher but should have a student section as you learn from someone your own age. It's more relatable.

MW: I agree. Course websites are best made by the teacher; however a student section of the website is useful as it allows student to student interactions, which has the benefit of sharing of concerns about aspects of the course with people in a similar position.

CT: It would be improved if there was some access to forums for questions during holiday periods and there could be links or a rolling feed of chemistry-related news. Also, the cork board was an excellent resource. I liked working in teams.

SN: Putting the Webquests on there allowed for more in-depth research into the topics, which was good.

Interviewer: Are there any other comments or questions?

(General shaking of heads and students looking at one another.)

Interviewer: Thank you for taking part.

APPENDIX 12: PARTICIPANT CONSENT LETTER SENT TO PARENTS AND CARERS

16th September 2011

Dear parents and carers

I am writing to you to inform you about a research project I am conducting for my MPhil in ICT in Teaching and Learning. My project focuses on the use of webtools and how they can be used to improve teaching and learning in schools. As this is an action research project, I should like some of my science groups to take part in the study and therefore I would appreciate if you and your child could read through the participant information sheet and informed consent form. If you consent to your child taking part in the study, you need do nothing further, but you may wish to keep this letter for future reference. If you do not consent to your child taking part in the study, or would like more information, please contact me at the school.

Yours sincerely

Christine Turner

Science Teacher

APPENDIX 13: PARTICIPANT INFORMATION SHEET SENT TO PARENTS AND CARERS

How can webtools improve teaching and learning?

Participant information sheet

Miss C Turner, <<School's name>> in partnership with The Design School, Loughborough University, LE11 3TU. 01509 222766. <<cturner@school email address>>

What is the purpose of this study?

This study is researching how webtools such as wikis, blogs websites and virtual learning environments (VLEs) can improve the students' perception of their learning and their teachers' teaching. It is hoped that by using webtools in their science lessons, students will feel that they are improving their learning, engaging with the lessons and retaining more knowledge.

Who is doing this research and why?

Miss Turner is conducting this research project because she wants to contribute to the continuing improvement of teaching and learning at English Martyrs School. The Design School at Loughborough University is supporting the research project.

What are the requirements?

Groups invited to participate in this study include all Year 9, 10 More, and Year 12 and 13 chemistry students. There will be a maximum of four short questionnaires during the year which will take less than an hour in total to complete. In addition, some students will be asked contribute to short, verbal interviews of their experiences of using webtools, throughout the year.

Once I take part, can I change my mind?

Yes! After you have read this information and asked any questions you may have, if you do not wish to take part in the study, then that is fine. If you initially take part and then change your mind and wish to withdraw from the study please contact Miss Turner. You can withdraw at any time, for any reason, without having to say why you are withdrawing. The data will be stored for 6 years and will be confidential. It will be stored in Miss Turner's home office. If you wish your data to be withdrawn at any time, please contact Miss Turner.

APPENDIX 14: INFORMED CONSENT FORM SENT TO PARENTS AND CARERS

INFORMED CONSENT FORM

The purpose and details of this study have been explained to me.

I understand that this study is designed to further scientific knowledge and that all procedures have been approved by Loughborough University.

I have read and understood the information sheet and this consent form.

I have had an opportunity to ask questions about my participation.

I understand that I am under no obligation to take part in the study.

I understand that I have the right to withdraw from this study at any stage for any reason, and that I will not be required to explain my reasons for withdrawing.

I understand that all the information I provide will be treated in strict confidence and will be kept anonymous and confidential to the researcher, unless (under the statutory obligations of the agencies which the researcher is working with) it is judged that confidentiality will have to be breached for the safety of the participant and others.

I agree to take part in the study.

APPENDIX 15: PERMISSION LETTER FROM PRINCIPAL

Ref: MC/PW

Loughborough University
Leicestershire
LE11 3TU

April 2010

To Whom it May Concern

I hereby grant permission for Christine Turner to conduct academic research with students at School between 2010-2014.

Yours sincerely

Marius Carney
Principal

Performing Arts Specialist Status

INVESTOR IN PEOPLE International School Award 2011-2014 Healthy Schools arts college

APPENDIX 16: YEAR 9 LESSON PLAN

Lesson Duration	60 mins	Lesson Title:	Metal Extraction Methods	Total Pupils	30
Date of lesson	19.4.12	Ability	Mixed	Year/Class	9 Sherwin

Aim of the lesson :	
AQA GCSE Science A – C1 topic 3 – Metals C1.3.1 (a) – (i) from specification Ores are naturally occurring rocks that provide an economic starting point for the manufacture of metals. Iron ore is used to make iron and steel. Copper can be easily extracted but copper-rich ores are becoming scarce so new methods of extracting copper are being developed. Aluminium and titanium are useful metals but are expensive to produce.	
Lesson Learning Objectives: Learners will develop their (skills/knowledge/ understanding/creativity and thinking/awareness and values) by learning...	
1	How to find out how different metals are extracted from their ores.
2	How to use etherpads to share ideas and improve literacy.
3	How to represent complex processes as simple flow charts.
Differentiated Learning Outcomes: By the end of the session (all/most/some) of the learners will be able to know/understand/demonstrate/explain/identify/etc.	
All/Level 4-5 will be able to match extraction methods to the metals.	
Most/Level 5-6 will be able to link the metals' reactivity with the extraction method.	
Some/Level 6-7 will be able to compare and contrast extraction methods.	
Project Focus Points and Evaluation of Effectiveness:	
Project Focus Point 1 (Web 2.0 Technology): What Web 2.0 technology are you using, why and how are you using it? We are using an etherpad (or a series of etherpads) using openetherpad.org and a corkboard using corkboard.me. We are using these because i) They are free to use, ii) The work the students complete is anonymous and can be captured and retained for analysis, iii) They promote literacy, iv) We have never used them before, v) We think that these collaborative tools may improve engagement, vi) Unlike most Web 2.0 tools they are not blocked by EMBC! Students will be working in groups (that are not sitting next to each other) to research and write some flow charts to show what happens when various metals are extracted from their ores. They will be using the etherpads to discuss the methods with each other and to support each other with the writing of the flow charts. They will use the corkboard to show me what they have learned in the lesson. How will you ***measure the impact*** of this focus point in the lesson (success criteria)?: Students should say that they feel their engagement and/or literacy has been helped in the lesson by using the Web 2.0 technologies; evidenced by the plenary questionnaires. Print outs from the etherpads should show that they have used them and have all contributed something. The corkboard should show a variety of comments about things that they have learned.	

Project Focus Point 2 (Improve Literacy): How will this lesson help to improve literacy skills within your lesson? This is a rather dry and literacy-heavy topic which students often struggle to access. The etherpads should stretch the more able and support the less able through collaboration and peer support. I will promote the need for good literacy on the etherpads when describing what the students need to do. How will you ***measure the impact*** of this focus point in the lesson (success criteria)?: Students should say that they feel their literacy has been helped in the lesson by using the Web 2.0 technologies; evidenced by the plenary questionnaires. Print outs from the etherpads should show good literacy (SPG, use of correct scientific vocabulary etc.) Students have been able to widely read various styles of website and process them to simplify them into flow charts.
Project Focus Point 3 (Engagement) : Who are the disengaged students (please list below)? How do you know they are disengaged and how will the lesson cater for the engagement of these students? Some students are on report for their behaviour, or have been in the past (a separate list will be given). These boys often go off task during lesson and have to be reminded to focus. One student works very slowly and needs support by the teacher. One student writes very little in his book on occasion. The website will allow the students to not be off task through random searching, by having appropriate hyperlinks for them to follow. Students tend to enjoy using the computers in lessons. They will have their own computer so there is less opportunity for them to not participate. How will you ***measure the impact*** of this focus point in the lesson (success criteria)? Students should say that they feel their engagement has been helped in the lesson by using the Web 2.0 technologies; evidenced by the plenary questionnaires. Students should have all participated in all stages of the lesson. Students are visibly working independently and collaborating, and are clearly engaged in the activity.
Differentiation strategy and working with other adults (e.g. teacher assistant (TA), mentor, technician)
The groups will be set so that there is a good spread of abilities in each group, for peer support. The questions at the end of the activities should challenge students as they are differentiated. There will be some self-differentiation also as students will write some simple or more complex flow charts. Some students will be able to compile a few and compare them. SM and RH will be supporting the lesson and taking still photographs of the students as appropriate. No teaching assistant is available for this group. SS (IT technician) may be available for technical issues if they arise.
What consideration needs to be given prior to the lesson? (i.e. setting expectation rules on how to use the technology in lesson? How you will save the produced work for assessment? etc.)
Students must only use their initials to identify themselves on the etherpads. Students must not use the chat bar on the etherpad for anything other than sharing ideas with their group and for me to give them announcements. Students must not delete others' work on any etherpad or corkboard. They may correct spelling, punctuation etc. After the lesson the etherpads will be downloaded as PDF files and printed, ready for analysis. They will be stored with ones from previous lessons. The flow charts will be saved onto the students' science areas. They can be printed if time is available or accessed by CT via the file viewer outside of lesson, and printed. Students must ensure that their name is on the flow chart. A screen capture of the corkboard may be taken after the lesson, and analysed. The website must be checked on the day of the lesson to ensure it is working.

Session Sequence

Time and duration (mins)	Teacher's activity	Learner's activity *Please highlight the episodes in which the project focus points are being addressed*	AfL strategies used in the lesson
8.45-8.50 5 mins 8.50 – 9.00 10 mins	**Settler:** Ask students to enter quietly, sit in boy-girl order and log on to the computer. Write the website URL on the board and ask the students to access it. Tell them to look through the site for what they are going to be doing and write the objective in their planner. **Starter** Give each one a number. Describe the objective of the lesson and ask students to open their group's etherpad. Ask students to find out about their extraction method using the hyperlinks.	Starter Students log on to the computer and access 9sherwin.yolasite.com and familiarise themselves with the site. They write the objective into their planner. Students are given a group number and begin to look through the links for info about the extraction technique.	Questioning, one to one and as a group if necessary.
	Key questions to ask: What metal are you researching? What extraction technique are you finding out about? Why is it used? How does it work? What are the advantages and disadvantages about using this technique?		
9.00 – 9.12 12 mins	**Episode 1:** Tell the students that having now found out about the different methods of extracting metals, they can share ideas by filling in the etherpad questions. Tell students that everybody must contribute something to their etherpad, and they must put their initials in the box.	Students use the 9Sherwin website and etherpads to research and discuss the extraction methods with other people in their group and the whole class. They fill in the etherpads with what they have found out about the extraction methods and use the chat bar to collaborate with each other e.g. which link/source they used to find out each piece of information.	Monitoring of etherpads using IWB.
9.12 – 9.24 12 mins	**Episode 2:** Tell the students they can now use their own etherpad and others' etherpads to fill in some flow charts to describe the processes. They may	Main activities – Students now draw some flow charts to show how the metals are extracted. They start with the method they researched. Students download the template, copy and paste the template or make	Peer support using etherpads and moving round room to check progress and

	download a template from the website to fill in or may draw their own. Tell them to save their work in their science folder. Tell students to write the steps for their extraction methods in order. They must put any reactants and conditions on the arrows.	their own. They could copy it into PowerPoint or Paint to fill it in and paste it into Word. If they want to use Word exclusively then they need to create their own flow chart or download the template from the website. Students then can use the other etherpads to help them to draw more than one flow chart.	give advice.
9.24 – 9.31 7 mins 9.31 – 9.34 3 mins	**Episode 3:** Ask students to view the questions in the tab on the website and answer them. They may start with whichever they feel is appropriate to their level. **Mini plenary:** Discuss the answers to the questions with the whole group.	Questions – Students answer the questions from the next tab. They can compare the flow chart they have drawn with what their neighbours have drawn to see how the methods differ. They then compare their flow charts and show how much they now know in a full group discussion.	Select some students from each group to contribute, rather than a hands up approach.
9.34 – 9.39 5 mins	**Plenary task:** Ask students to access the corkboard and post something they have learned about each metal/extraction method. Call the class to order and highlight some good comments.	Plenary Students write a post it note on the corkboard to show what they have learnt in the lesson. They post their comments under the correct headings and use the correct colours for each metal.	Students can view one another's comments and group discussion of which post-its were good and why.
9.39 – 9.44 5 mins	Questionnaire Ask SM and RH to hand out and collect in questionnaires.	Students complete questionnaires as they are logging off.	
Records and Risk Assessment			
Records: Group English and Science assessment data. Risk assessment: Usual computer safety e.g. no food and drink.			

Table 16.1: Lesson plan for TDA Year 9