An investigation into the role of a wiki in supporting collaborative learning activities

Thesis

An investigation into the role of a wiki in supporting collaborative learning activities

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Abstract

Providing students with learning opportunities based on real-life situations has been found to enhance student learning. With this aim, two Open University post-graduate courses introduced collaborative activities modelled on workplace situations. The activities employed wikis: a lightweight, web-based collaborative authoring environment. The purpose of this research has been to investigate the role of a wiki in supporting the collaborative learning activities, and to assess how the wiki influenced student engagement with the activities.

The dissertation draws data from the three presentations of Open University courses' 56 wikis produced by almost 240 students. The base data includes wiki content and student discussions. Issues identified in the base data were further explored through post-course questionnaires and interviews. An iterative inductive qualitative analysis was applied to analyse students' perceptions and experiences with the wikis. Activity theory was used to place these within the context of the activities.

The wikis enabled all student groups to author collaboratively the documents required by their courses. Writing the documents benefited the students because it prompted discussion and personal reflection; both of which many students reported as enhancing their learning. The students particularly valued the wiki's role as a central repository that helped them achieve these two benefits. The research shows that wikis can support collaborative activities among students and lead to enhanced learning opportunities. The key findings suggest that a wiki's simplicity enabled students to engage easily with the collaborative learning activities. However, a wiki's lack of inherent structure hindered their progress until they had worked out how to organise their use of the wiki.

The insights from the research are presented as guidelines for educators intending to incorporate wiki supported collaborative learning activities into their courses. The guidelines have two aims: first, to help educators facilitate speedy induction and participation of the students in the collaborative activities; second, to ensure the wiki is used effectively by students to increase their collaborative learning opportunities.

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Chapter 1 Introduction

1.1 Topic of the research

I wanted to find out how a wiki can best be used for educational purposes. This thesis documents my investigation into how a wiki can be used to support collaborative learning activities in distance-education courses. From the investigation findings, a set of good practice guidelines is produced to help other educators make effective use of a wiki in collaborative learning activities.

A wiki is an asynchronous collaborative authoring tool. Wikis are readable and writeable websites in which all the visitors to the site can create new pages or modify existing ones (Choate, 2008). Wikis are claimed to excel at supporting collaboration and have been "*designed to facilitate exchange of information within and between teams*" (Goodnoe, 2006). The best-known application of a wiki is the collaborative online encyclopaedia, Wikipedia. This is written and maintained by thousands of contributors from around the world exploiting the advantage of wikis to allow them to edit content directly. However, the first wiki was devised to meet the needs of software engineering (Leuf and Cunningham, 2001).

Wikis in software engineering

The first wiki, WikiWikiWeb (#WikiWikiWeb), was created by Ward Cunningham in 1995 to make the exchange of ideas between programmers easier. Wikis have since proven very popular in software engineering and are used to support collaboration within software teams. In the open source movement, wikis are now universal. All projects hosted on Sourceforge (#SourceForge) and GitHub (#GitHub) are provided with wikis (#SourceForge:Tools; #GitHub:Features).

The general use of wikis in business generally seems to have been growing too (Goodnoe, 2006). Though Majchrazak *et al* (2006) in a survey extending over 168 corporate wiki users found the most common use was for software development. They also found cases of wikis being used for tasks that support software development such as knowledge management, project management and information sharing. Arazy *et al*'s (2009) more focused investigation into the use of wikis within IBM found that more than a third of IBM employees were using wikis within 18 months of wikis first being made available to them.

One particular use of wikis is for supporting non-collocated teams. Damian (2007) reports the strategies involved in managing stakeholders in global requirements engineering. Issues arise when software teams are separated from their clients and the requirements analysts. They may even be located on different continents. Yet, there remains the need for intensive communication and collaboration, something that Damian notes can be addressed by using a wiki as a central repository. Decker *et al* (2007) similarly examined the issue of dispersed teams in industry. They conducted a research study between 2003 and 2005 that involved 12 people only, which the authors acknowledge to be a small sample. In their study, they found that "*wikis are indeed useful for stakeholder collaboration, as well as for grouping and structuring requirements.*"

The issues raised in industrial practice by Damian and Decker *et al* are similarly applicable when the students are not collocated as when engaged in distance education. Wikis could provide the means for communication and collaboration among students, as well as a central repository for collaboratively produced documents. Hence, it could be beneficial for computer science students to use wikis in their studies because they are likely to encounter similar issues regarding collaboration later in their careers in industry, and to use wikis as the solution to those issues. Lave and Wenger (1991) argued that the disjoint of work and educational experiences not only undermines the students' later potential to contribute at work but also only hinders their learning. Incorporating wikis into computer science education enables students to acquire a transferable skill and, through appreciating the course tools' relevance, engage with the course material.

Wikis in education

Wikis are popular in software engineering because they enable collaboration among the software developers (Goodnoe, 2008). Collaboration is also recognised to benefit to students' learning because students have to explain and refine their experience and understanding of the concepts to be learnt (Laurillard, 2002). This model of learning is derived from Vygotsky's work on child development in which he proposes that knowledge is constructed by a child through reflecting on shared experiences (Vygotsky, 1978). Social constructivist pedagogy is an application of this model of learning in education. Courses embodying the pedagogy, incorporate learning opportunities that take place in a social context where learners can share and discuss their evolving understanding of new concepts (Felix, 2005).

The learning process can be supported by technology (Laurillard, 2008), especially when the technology enables collaboration among students studying a distance-education course who could not otherwise interact. This collaboration can lead to collaborative learning, which is defined by Kaye (1992) as "*individual learning as a result of [a] group process.*" In providing an environment in which students can collaborate to share knowledge, educators are realising the potential of wikis to facilitate collaborative learning.

Hence, wikis can provide a double benefit to computer science students. Not only because there are opportunities for enhanced learning through wiki-enabled collaboration but as already noted, because using a wiki is in itself valuable learning as the students acquire a transferable skill.

Evans (2006), in his overview of wikis' potential impact on business, identifies that students need to learn what wikis may mean to business and the skill to use them. He suggests there is a need to teach three things: the subject domain itself, the wiki technology and the supporting transferable skills.

Transferable skills have long been recognised as important for graduate careers. Harvey *et al* (1997) reported that, "*… communication skills emerge as one of the most important, if not the most important quality that employers require of graduates.*" A meta-analysis conducted the following year by Burden and McAvinia (1998) found a demand for a similar set of transferable skills. The most commonly cited skill was 'communication' with 90% of sources referring to it. The second most common skill was 'teamwork' with 50% of sources. The need to collaborate in a course provides students with the opportunity to improve their communication skills and teamwork skills. The drive to provide students with transferable skills has led course designers to incorporate collaboration as a learning outcome into their courses (Bower and Richards, 2006). Students have also recognised the potential benefit of transferable skills. Those studied by Flood *et al* (2004) cited acquiring transferable skills as important to their learning and satisfaction. Raza Ali (2006), in suggesting improvements to training graduate software engineers, highlighted the need to develop their collaborative working skills. He argued that software engineering graduates would be entering a workplace where there is an increasing use of agile technologies and Extreme Programming techniques, both of which demand collaboration among the participants. Hence, through engaging with wikis in a collaborative learning activity, all students have the opportunity to acquire several transferable skills, with computer science students having the added benefit of working with an authentic tool.

It is to realise these several advantages for students that this research is based on the use of wikis in computer science education.

Research questions

The primary objective of this research was to investigate the following research questions:

Are wikis a usable medium for collaboration in an educational context?

Can a wiki enable a social constructivist activity?

What are the challenges in using a wiki in a social constructivist educational activity?

A review of the existing literature has shown that the questions cannot be addressed from published empirical investigations.

The first question is the fundamental building block upon which everything else must be built. The wiki is designed to be easy to use, with minimal support and guidance. This question seeks to confirm if this claim applies in an educational context, as well as in the software engineering domain where the claim was first made.

A wiki is a tool, and should only be used if its serves a benefit in that context. The second question seeks to answer this question. It considers the motivation for including collaborative activities in teaching and learning, and the potential role a wiki can play in supporting elements of those activities.

The third question is a synthesis of the previous two as it seeks to understand if the students' use of the wiki was in the manner intended by the course team who designed the collaborative activity, and whether the students gained the intended benefit. The answer is sought in determining the challenges encountered by students when using a wiki, and the impact of them on the students.

The answers to the three research questions are used to identify good practice guidelines for educators when using wikis to support collaborative learning. The guidelines are especially relevant to computer science education, but could be applied to other subjects.

1.2 Background to the research

The Open University (OU) has around 200,000 adult distance students who mainly study part-time. The OU was specifically set up to provide a distance-education to those who could not make use of the traditional campus-based full-time alternative. To enhance its home-based students' learning experience, the OU has a record of exploiting emerging technologies. This led to notable pioneering work in the 1970s with the use of television broadcasts to supplement the printed course materials. The OU's use of technology has evolved in step with technological changes, especially the internet (Thomas *et al*, 1998). The OU was an early user of dedicated online Computer Mediated Communication (CMC) tools such as FirstClass (#FirstClass) for asynchronous text-based discussions and Lyceum (#Lyceum), an audio-conferencing tool with shared workspace, for synchronous collaborative activities for student mutual support and formal use in learning activities. The most recent development in the OU's use of technology is the introduction of an integrated virtual learning environment (VLE). The adoption of the open source VLE, Moodle (#Moodle) offers course teams a wide range of collaborative tools.

This has given the opportunity to gather and evaluate data to answer the research questions in the context of distance-education.

Data sources

Two courses were used as the data sources for this dissertation. The first is a requirements engineering course, the second is a management course that makes similar demands on its students as the requirements engineering course. The two courses are post-graduate courses that incorporate collaborative activities. The requirements engineering course provides the baseline data for this study, with the management course providing contrasting information to enhance the validity and reliability of the research.

Computing course: Software requirements for business systems

This course teaches the systematic eliciting, recording and communication of requirements for software systems. This process is commonly known as Requirements Engineering (RE). More information is available at the course's web site, http://tinyurl.com/2pke2k, and the course collaborative activities are described in more detail in Chapter 4.

On a software development project, eliciting requirements is generally carried out by a team of requirements engineers or system analysts. In software enterprises, such teams are increasingly using wikis to develop requirements specification documents collaboratively (Farrell, 2006; Ras, 2009). The aim of introducing collaborative activities in a wiki environment on the course was to emulate this team experience and allow a group of students to discuss a set of requirements, remove conflicts in the requirements, and produce an unambiguous requirements specification in ways similar to those used by requirements engineers in practice. Through the need to author collaboratively the requirements the course team of the RE course intended that students would have the opportunity to discuss the course concepts too, thereby enabling collaborative learning.

Business Course: Current issues in Public Management and Social Enterprise

This course is aimed at keeping professionals up to date with current debates and topics in and around the public and not-for-profit sectors. More information is available at the course's web site, http://tinyurl.com/6njhtk, and the course collaborative activities are described in more detail in Chapter 4.

It is the second of two specially prepared core courses in the OU's Master of Public Administration (MPA) degree alongside *Shaping Public Policy: contexts and processes*. Within the context of the whole MPA degree, the course continues a progression of learning modes that begin with highly structured individual activities at the start of the programme to more learner-designed investigations towards the end. As part of this progression, the course "*emphasises learning through researching, working collaboratively in teams to achieve agreed and negotiated objectives, undertaking peer review and responding to peer critique*" (taken from the Business Course Guide).

The Business course's course team identified five current management issues, from which each student chooses two to work on. For one of the chosen issues, the students collaborate with others who made the same choice and use a wiki to prepare a joint report on each issue. Students then individually relate the issue to their own organisation or one they know well. Thus, the students have the opportunity to learn collaboratively through sharing these different experiences.

The students then repeat the same activity in a new learning group for their second chosen issue and submit a second assignment. This means that the students can build on their experience of using a wiki and of teamwork from the first activity, and concentrate on the issue under review in the second.

Contrast between the courses

The two courses are similar enough to provide comparable data, in that both are intended for post-graduates and both involve collaboratively authoring a document. However, they are drawn from different domains and have several detailed differences to provide an informative contrast. The similarities and differences are explored in more detail in Chapter 4, Course collaborative activities and course team intentions.

1.3 Overview of the thesis

Figure 1-1 shows the structure of this dissertation, and how the dissertation will document both the research process and the research results.

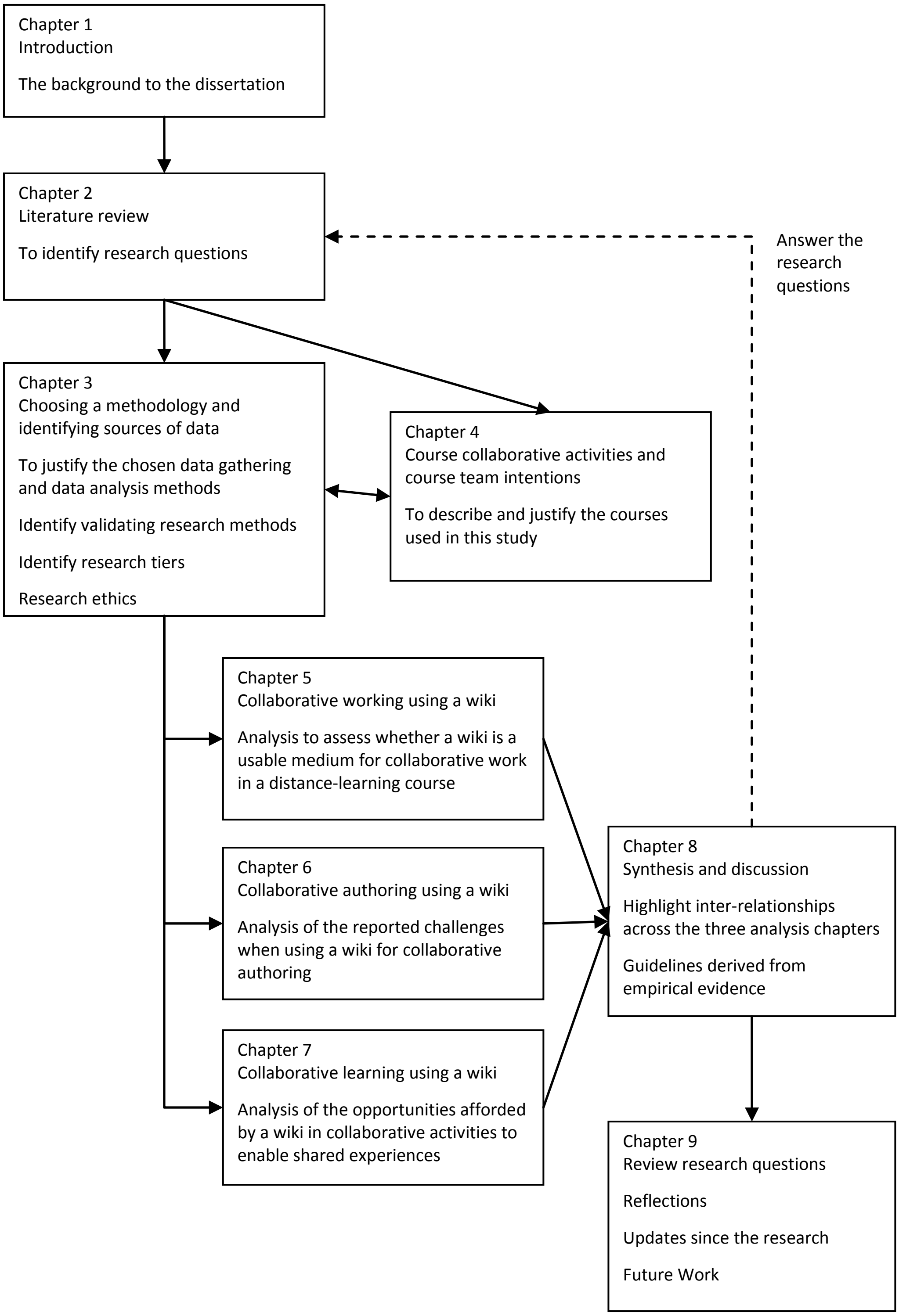

Figure 1-1: Chapter structure for thesis

The research design, showing the research process and how the selected methodologies address the research questions, is pictured in Figure 1-2.

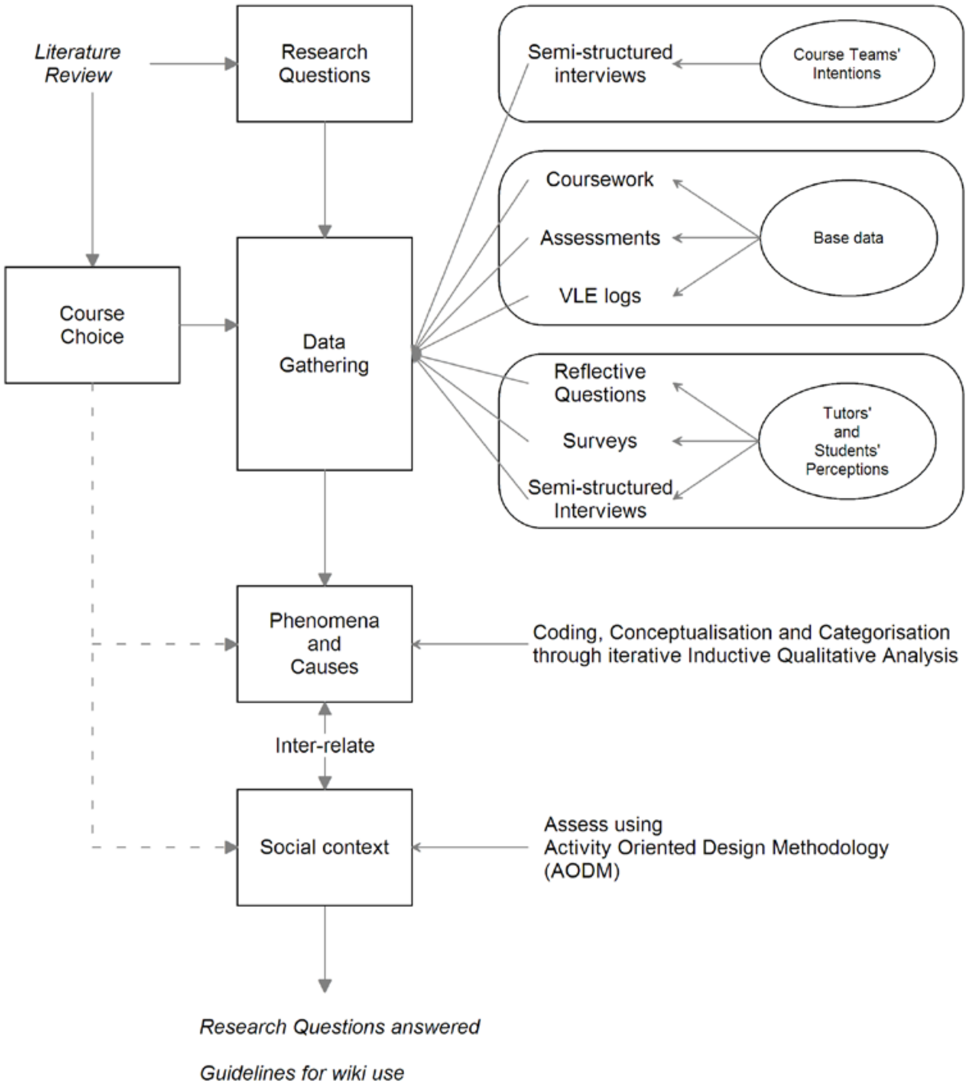

Figure 1-2: Research design for thesis

1.4 Chapter summaries

The body of the thesis is organised as follows.

Chapter 2 presents a literature review to identify gaps in existing published material and thereby define and justify the current research to address the outstanding issues.

Chapter 3 covers the methodologies used in this thesis to answer the research questions. It details the choice of data gathering and data analysis methodologies, justifying the choices made and their contribution to the validity and reliability of this research.

Chapter 4 describes the collaborative activities that were the source of the data used in the thesis. It details the courses and activities, explaining how they are similar enough to provide a useful comparison, yet different enough to provide contrasting data.

Chapters 5, 6 and 7 present the data analysis for each of the three research tiers the merged from the initial inductive qualitative analysis. The questions are answered sequentially so as to build upon the preceding chapter. Therefore, the first question considered is the ability of a wiki to support collaborative work (research tier 1) is presented in Chapter 5. Then the ability of a wiki to support collaborative authoring (research tier 2) is presented in Chapter 6. In conclusion, the ability of a wiki to facilitate collaborative learning (research tier 3) is presented in Chapter 7.

Chapter 8 brings together and summarises the findings in the previous three chapters and how these findings relate across the chapters. It includes a discussion on guidelines that can be derived from these findings, and of their limitations.

Chapter 9 concludes the thesis by reviewing the research questions and discussing the contributions from this research, the limitations of the findings and future work.

Chapter 2 Literature Review

2.1 Introduction

This chapter presents an examination of published papers describing contemporary research relevant to the research topic set out in Chapter 1. The chapter draws on literature from several domains to cover the technical aspects of wikis, the educational aspects of collaborative learning activities, and the overlap that is the subject of this research. A critical review of the literature identifies the questions that are the basis for this research.

This chapter contains four substantive sections. The first, Section 2.2, defines a wiki. The next three sections address each of the research questions through reviews of published papers relating to wiki use, especially in software engineering and computer science education. From this critical review, three high-level research questions are identified:

1. **Are wikis a usable medium for collaboration in an educational context?**
2. **Can a wiki enable a social constructivist activity?**
3. **What are the challenges in using a wiki in a social constructivist educational activity?**

The chapter closes with a summary.

2.2 Wikis and their characteristics

A wiki is a collaborative authoring tool. Ward Cunningham created the first wiki in 1995. He wanted a shared, easy to use editing tool whose output could be published on the internet (Leuf and Cunningham, 2001). A wiki consists of a collection of pages. A user can visit a wiki and create, edit or delete content using only a web browser. All users have the same access rights to change a wiki's content. A wiki has simple locking mechanisms to prevent change conflicts.

Two distinguishing features of a wiki

The two key features of a wiki are its simplicity and flexibility (Reinhold, 2006). A user need only have access to a web browser to use a wiki. There is no need for additional software to be installed and maintained. The wiki has no pre-defined page layout or links among the pages. The expectation is that the internal structure will emerge from actual practice when using the wiki, and so be optimised to a user's needs.

Two example wikis

Figure 2-1 shows the Frequently Asked Questions page from the Leo wiki (#Leo:FAQ), a wiki true to Ward Cunningham's original concept. Leo is an outliner application and is open source software. The wiki exists for its developers and users to document all aspects of the application. The wiki is purely text based and has a simple layout. This simplicity is in contrast to probably the best-known wiki, Wikipedia.

As shown in Figure 2-2 Wikipedia's Home page has a multi-column layout, embedded pictures, and both side and top navigation bars. Ward Cunningham as part of his original wiki concept did not envisage these features because they are not necessary for collaborative authoring. Through reducing the features available to users, Ward

Cunningham sought to minimise the users' learning time and support needs to use a wiki.

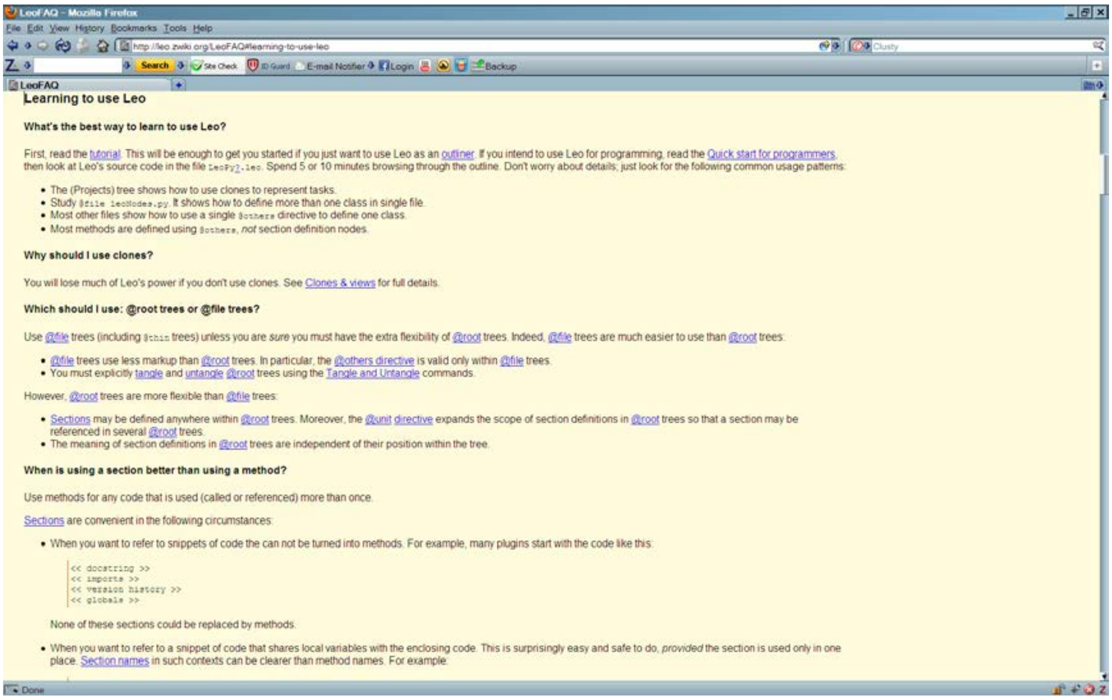

Figure 2-1 Leo's FAQ page

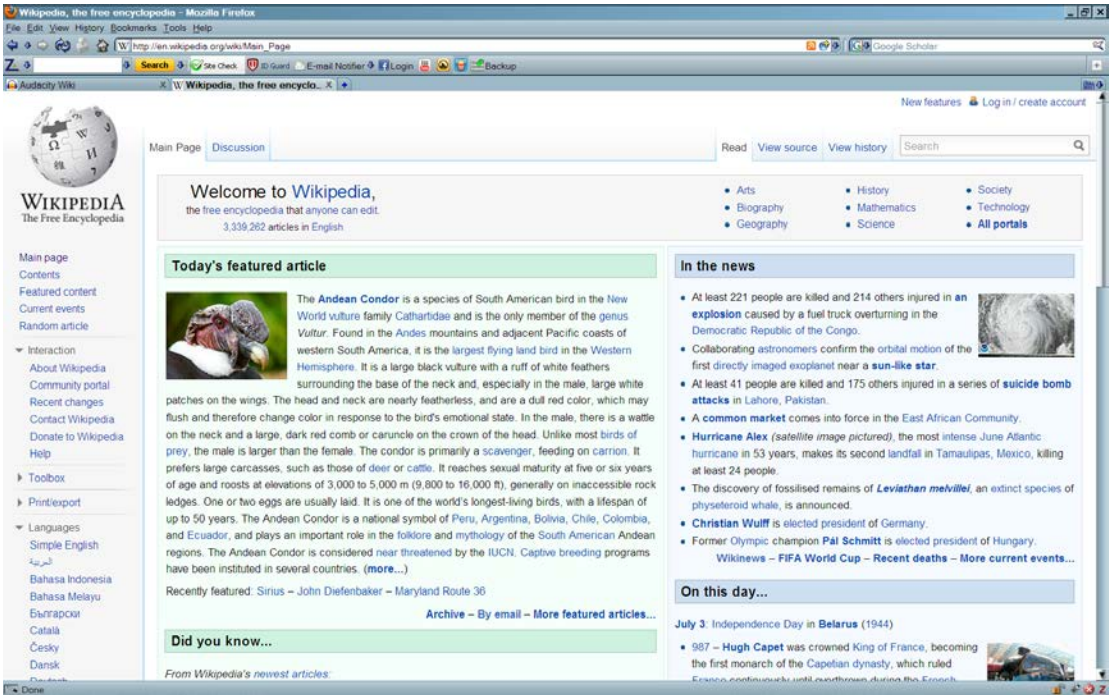

Figure 2-2 Wikipedia's home page

In addition to losing some of a wiki's simplicity, Wikipedia has also lost some flexibility. The page structure is defined for contributors. There are standards and rules for contributors to adhere to. In one sense, this represents a mature wiki, one in which an effective structure has emerged as Ward Cunningham intended. However, now that Wikipedia has a defined structure, further change is difficult. The ability for new structures and rules to emerge is limited as demonstrated by a failed request of Professor Page of Glasgow University to enhance taxonomic descriptions (Page, 2010).

These two examples demonstrate the range of web sites that can be produced with wiki software. The emphasis in this research is on a simple wiki because that is the form that is prevalent in software engineering (Louridas, 2006).

2.3 Literature on the usability of wikis in education

Comparing wikis with other collaborative authoring tools

Ward Cunningham devised the wiki to be usable and overcome the disadvantages of contemporary online collaborative tools, commonly called groupware (Choate, 2008). Groupware includes products such as Lotus Notes (#Notes) and Microsoft Exchange (#Exchange). These products require expertise to install and configure, and continuing support and administration. They also require trained users.

Today, as well as wikis and groupware, there are other online collaborative tools to facilitate document sharing and editing. Kamel Boulos and Wheeler (2007) list several examples including Gliffy (#Gliffy), Google Docs and Spreadsheets (#GoogleDocs) and Microsoft Office Live (#OfficeLive). These other tools are not the same as a wiki because:

- They may require web browser add-ons to enable all their functions, eg Office Live.

- They require registration to access and share documents, eg GoogleDocs.
- They can be sufficiently complicated that the user needs to invest considerable effort to learn how to use them, eg Gliffy.

Hence, these tools lack a wiki's advantages, especially ease of set up and ease of use.

There are other online authoring tools, but they do not support collaborative authoring. They are discussed briefly to highlight the specific features of wikis that support collaborative authoring.

A blog is an online authoring tool but unlike a wiki there is only one author. Readers cannot create or edit content, they can only append comments. As Dalsgaard (2006) notes, a blog primarily supports individual work. In education, blogs provide students with an audience for their writing and can invite discussion (Kennedy, 2003). Knowing they are writing for an audience can encourage a greater sense of personal responsibility (Godwin-Jones, 2003). Blogs can also be used as journals or portfolios to record a student's progress and accomplishments, as well as reflections (Weller *et al*, 2005). Blogs can permit more than one author to post an entry. These are known as collaborative blogs. However, further contributions are constrained to comments on the post. The post itself cannot be edited.

Forums are another form of online communication, but as with blogs, they offer the opportunity to comment on another's writing rather than to share in the writing. Like blogs, readers can append comments but not change the original content. This is in contrast to the dynamic content of a wiki. In effect, both blogs and forums are a form of broadcasting where the tool permits one author to reach many readers. This does not stop either tool approaching the wiki's ability to support many-to-many communication. As Franklin and van Harmelen (2007) report, a group of students can comment on their individual blogs and develop shared knowledge based on mutual posts and comments. However, neither blogs nor forums allow the collaborative authoring of a common document in the same way as a wiki can.

Conversely, wikis can approach the functionality of blogs and forums through a 'thread mode' (#ThreadMode). In thread mode, users make signed contributions to a page leaving earlier contributions intact. This is similar to a blog or forum in which users append contributions to a shared page. Thread mode enables users to discuss a wiki web site's content by using a dedicated page also within the web site. Thus, the discussion is adjacent to, but separate from, the content being discussed.

Using a wiki without training

Wikipedia is a good example of how easy a wiki can be to use, for none of its users have received formal training. Wikipedia's English edition has 14,808,869 registered users, who have created 3,667,928 articles. The active nature of the users' contributions can be seen in the 470,098,081 edits[1]. Each *Article* page is accompanied by a *Discussion* page, and many of the edits relate to users taking part in the accompanying discussion rather than modifying content. Perhaps Wikipedia's most controversial discussion was that regarding Jyllands-Posten's publication of cartoons depicting Muhammad (#Wikipedia:Muhammad). The ease with which hundreds of comments were made demonstrates that a wiki can facilitate discussion.

The Wikipedia discussion page works in thread mode, and hence offers the same functionality for comments as does a blog. However, a blog does not permit commentators to edit the content as a wiki does.

[1] All Wikipedia statistics collected on 26 June 2011.

Wikis as a Content Management System

There is a third way to use a wiki beyond document and thread modes. This is using it as a Content Management System (CMS). When used as a CMS the shared content is written in documents attached to a wiki page rather than written in a wiki page itself. As a Project Locker whitepaper (2006) summarises, a wiki differs from a conventional CMS in four ways:

> *"Wikis are cheap, extensible, easy to implement, and don't require a massive software rollout because of their ability to interface well with existing network infrastructures.*
>
> *Wikis are Web-based and thus present little or no learning curve in the adoption cycle.*
>
> *Wikis allow the user to determine the relevancy of content rather than being dependent upon a central distribution center or a linear distribution chain.*
>
> *Wikis organize themselves organically, allowing users to create their own site structure, or ontology, rather than have it imposed upon them by the developers of content management software."*

All four points highlight the ease of use of a wiki compared to a conventional CMS. The ProjectLocker (2006) authors argue that the benefits allude to the "*inherently collaborative nature of wikis, as opposed to the workflow structure of content management software.*" Arguably, the collaborative nature of wikis identified in the whitepaper just represents another aspect of a wiki's inherent simplicity and flexibility removing the technical barriers to users' collaboration on the web (Choate, 2008). This suggests that the benefits of simplicity and flexibility may be applicable no matter how a wiki is used.

Wikis' suitability for use in education

Leuf and Cunningham (2001) envisaged that wikis could support collaborative work in an educational setting and enjoy the same advantages as wikis used in software engineering. Reinhold (2006) summarises that vision as being "*the Wiki* interactive pages *model of collaboration allows participating members to actively work on the same materials online… to be authors and readers at the same time, and to easily build information networks.*" McMullin (2005) in his review of emerging web 2.0 technologies in education states, "*The "barriers" to entry [for using wikis] are extremely low.*" Echoing the sentiment already applied to wikis in a general context (ProjectLocker, 2006).

It is the simplicity and flexibility of wiki that makes it an appealing tool for content sharing and online collaboration. This has led to wikis being described as "*the easiest and most effective Web-based collaboration tool in any instructional portfolio. Their inherent simplicity provides students with direct (and immediate) access to a site's content, which is crucial in group editing or other collaborative project activities"* (Educause 2005).

Wikis enhanced for use in education

There are several reported uses of enhanced wikis in education; one such is Forte and Bruckman's (2007) 'ReferenceTools' for bibliographic citations. This is an extension they developed for MediaWiki, the wiki engine used by Wikipedia. However, there are disadvantages to creating extensions. The first is to the institution using the extension. There will be a long-term support commitment as the tool might require maintenance when MediaWiki is upgraded. There are also potential disadvantages for the students. The extension requires initial training to use, time that will have to come from the course schedule. In addition, the students might come to expect the extension to be generally available in other wikis they encounter during their education and afterwards at work. To avoid these disadvantages, the current research reported in this dissertation focuses on simple wikis, devoid of additional features. While the extensions may be successful in meeting a perceived need, their presence does detract from the originally defined benefits of using a wiki.

Wikis used in education

That there is a role for wikis is apparent from their reported increasing use in education (Lund and Smørdal, 2006; Crook *et al*, 2008). None of these authors report problems with students learning to use wiki software. However, there is one example in the literature of students having problems understanding their wiki.

In Désilets *et al's* (2005) study, 15 primary school pupils aged 8 and 9 were divided into 6 groups and given minimal instruction before using a wiki to author collaboratively an adventure story. Of the recorded problems, 62% were due to hypertext and 49% to link creation, problems could be in more than one category. Both of these categories are specific to the wiki and so had not been encountered by the students previously. Even then, many of the problems, 40% of the link creation problems for example, were relatively trivial such as forgetting to use underscores in place of whitespace in link names. The authors' concluded that a wiki is indeed usable by non-technical users.

There is a rich body of literature suggesting the ease of use of wikis. The success of Wikipedia is frequently cited as evidence of the ease of use of a wiki. This supposition is supported by published refereed articles covering industry and education. However, these articles are mainly reviews and not empirical studies. As noted by Désilets *et al* (2005) "*In spite of much anecdotal evidence to the effect that wikis are usable by non technical experts, this has never been studied formally.*" Therefore, the primary question that underpins all this research remains unanswered, and asks if a wiki really is usable for collaboration in an educational context?

This leads to the first research question:

Are wikis a usable medium in an educational context?

2.4 Literature on wiki-enabled activities in education

Varieties of wiki enabled activities

A consequence of a wiki's unstructured nature is that users have almost complete freedom over the content writing process without formal workflow, access restrictions or predefined structures to constrain them. This means that wikis can support a variety of activities, and that users can make their existing working practices define their use of the wiki (Schaffert *et al*, 2006). Examples given by Schaffert *et al* include:

- encyclopaedia systems: collect knowledge in a certain area (e.g. Wikitravel) or unrestricted (e.g. Wikipedia) in a community effort with contributions from a wide range of users;
- software development: collaboratively create documentation, collect ideas, track bugs; most of today's high-profile Open Source projects (e.g. Apache, Mozilla, OpenOffice) use wikis for coordination;
- project knowledge management: brainstorming and exchange of ideas, coordination of activities, coordination and records of meetings, notepad for common information items;
- personal knowledge management: sketchpad to collect and elaborate personal ideas, addresses, dates, tasks, bookmarks, etc.

All, except the last, represent some form of collaborative authoring.

Personal knowledge management seeks to leverage a person's experience with an authoring too and to exploit a wiki's advantage of not requiring special software, only a web browser. One example of a personal knowledge management wiki is TiddlyWiki (#TiddlyWiki). This repurposing of a wiki as a note-taking tool does not exploit the wiki as a collaborative authoring tool, and so falls outside the scope of the current research.

There is, however, an educational practice that does seek to exploit a wiki in the manner envisaged by Ward Cunningham and use it as a collaborative authoring tool. This is social constructivist pedagogy.

Social constructivist pedagogy

Constructivist pedagogy is the practical implementation of constructivism, a theoretical model of how learning happens (Duffy and Jonassen, (1992). There are two main varieties of constructivism arising from differing studies into child developmental psychology (Piaget, 1977; Vygotsky, 1978). All varieties of constructivism reject the transmission model of teaching that informs traditional instructivist pedagogical practice in which knowledge is passed from a teacher to the learner. Education has been moving away from instructivist pedagogy towards constructivist pedagogy (Laurillard, 2002).

Derived from the ideas of constructivism, constructivist pedagogy views knowledge as something constructed by the learner rather than something given to the learner, a view that informs the design of educational materials. Felix (2005) notes that there are two main forms of constructivism and two matching constructivist pedagogies:

- cognitive constructivism (derived from Piaget's work) focuses on interaction with content and the individual construction of knowledge. Applied to education, e-learning tools used by an individual, such as interactive CD-ROMs, can provide an appropriate learning experience.

- social constructivism (derived from Vygotsky's work) focuses on interaction between people and the co-construction of knowledge. Applied to distance-education, shared e-learning tools are required to provide interaction with fellow learners.

The need for collaboration in social constructivist pedagogy arises from Vygotsky's theory that the personal creation of knowledge is not a private matter, but a social concept (Vygotsky, 1978). Vygotsky proposed that a learner could refine their naïve conceptions. Through collaboration, the necessary discourse would foster a rich learning environment and assist learners to construct and reconstruct their knowledge through reflection

In applying this social constructivist theory to education, the emphasis is on providing shared experiences from which Vygotsky (1978) called for *collaborative, situated and active learning*. Van Merriënboer and Pass (2003) interpret this call as leading to learning activities characterised by:

- group collaboration, interaction and cooperation so that there is the opportunity for *discourse*;

- complex and realistic problems (*authentic activities*) so that the learning is situated in real world experiences;

- goals set by the students, so that while teachers provide guidance, the students own the task and hence engage in *reflection*.

Laurillard (2002) relates these characteristics of social constructivist pedagogy to online communication tools, in particular how they can support students' dialogue, be it external discourse or internal reflection. She states that online communication tools are useful because students can articulate and re-articulate their descriptions of the topic in response to others' ideas and comments, and then reflect on the discussion to clarify their own understanding.

A wiki is capable of facilitating Laurillard's application of social constructivist pedagogy. Its content can be edited, unlike blogs and forums that only permit new material to be appended to the original. This means that a wiki facilitates the re-articulation of a student's ideas better than those other tools. In addition, because a student can review the development of their writings through the wiki's history function there is a record to support reflection.

As Tétard *et al* (2009) summarise in their review of using wikis to support constructivist learning, *"Informality is at the core of the wiki concept: wiki sites invite users to freely and easily contribute to the content of a wiki"*. Through lowering the barrier to taking part in an online activity, a wiki can support engagement of the student with the activity.

The ability of students to be active participants is reinforced by equality among wiki users. All users of a wiki have equal access rights. In his review of the potential of wikis, Lamb (2004) states that this equality of wiki users breaks down the barriers between 'content creators' and 'content consumers'. Other tools may demand pre-defined roles among their users, so that some gain an authority over their peers. Using a wiki, all can participate equally, and hence all can actively engage with the activity as required by social constructivist pedagogy.

The next three sub-sections consider the wiki as an online communication tool and how it can support the three elements of a social constructivist learning activity: discourse, authentic activities and reflection.

Supporting discourse with a wiki

Parker and Chao (2007) in their literature review, identify several benefits of the applications of wikis including enhanced interaction and group work, and a sharing of knowledge and expertise within the group.

Investigating the importance of interaction in discourse, Piccicano (2002) studied 23 students on a graduate course in education administration. The students' discourse was conducted using the asynchronous communication tools within Blackboard, a commercial course management system (#Blackboard). Owing to the small numbers of students in the study, Piccicano undertook qualitative analysis only. The analysis identified a significant correlation in the written assignment: the high interaction group scored better in the end of course examination.

The written assignment required students to assimilate multiple viewpoints. Piccicano suggested the assimilation was easier for those students who participated in the online discussions because they were actively articulating the different viewpoints to their peers. However, in other assignments where personal reflection on the material might suffice alone for assimilation of ideas, the correlation between a student's participation in discourse and a student's examination results broke down. This result suggests the importance of discourse in a student's learning.

Supporting authentic activities with a wiki

The authentic nature of a collaborative learning activity can encourage student engagement as well as providing practice with a skill directly applicable to a student's career. An example of successful wiki-enabled authentic activity in software engineering is described by Chao (2007).

In Chao's study, a wiki was used for undergraduate student project collaboration in a project-based software engineering course. This was a small-scale study of 38 students. The students were divided into groups of 9 or 10, with the wiki used to cover most of their project communications from requirements through project planning and tracking to test case management and defect tracking. The students were primarily developers but all were expected to share in the managerial tasks. The end of course survey received 28 responses. The survey was of relatively limited scope but did show that 25 students thought the wiki a good tool for project collaboration overall and had used it regularly, while two were neutral in their opinion of the wiki, and one alone thought it bad. Unfortunately, the survey did not provide the scope for students to justify their answers or to distinguish those features of the wiki that were good from those that might have been bad in supporting their group work. Hence we have a potentially interesting result, but without gaining an understanding of the students' motivations.

In another example of an authentic activity, Forte and Bruckman (2006) report a pilot study with an undergraduate student writing exercise. The students were expected to produce a science paper. A total of 19 students participated but not all of them for the entire pilot. The primary object of the activity was for them to learn about the writing process. To create an authentic experience for their students, the authors modelled the activity on writing an article for Wikipedia. The activity was judged a success by the authors because the students came to appreciate the public nature of their writing, and the importance of understanding the intended audience for the writing. However, the authors do not report the students' perspective on the activity.

The small-scale studies in the literature suggest that authentic wiki-enabled activities can be delivered and judged a success by the teaching staff. However, there is a gap in reporting the students' view.

Supporting reflection with a wiki

Wikis maintain a written record of their changing content. This permits students to review their developing ideas and reflect upon the material. Several overview papers such as Parker and Chao (2007) and McMullin (2005) cite the beneficial role a wiki could play in reflection. This view is supported by the one in depth study published on the topic.

Chen *et al* (2005) define *reflective learning* as structured approaches that enable students to reflect upon their learning and to understand their own learning processes. They identify this as one of the critical features of constructivism. They conducted a study to see if wikis and blogs could assist a student's reflection. In particular, could a wiki help students on project-based courses overcome the problem that they see "*what they have produced but they do not see what they have learned.*" In other words, the students could reflect on the material they had produced, but not the effect that material might have had on their learning.

Chen *et al* added wikis and blogs to an existing undergraduate project-based course on Design Engineering to see if the students would use the additional tools to help them reflect on what they had learnt as well as on the product they had produced. Using a wide variety of data gathering methods, both qualitative and quantitative, the results suggested that the students did use the tools to integrate their thoughts, the course resources and their individual experiences. The study continued with a second presentation of the course. The authors reported encouraging results. They ascribed the improved performance to several – unspecified – problems in the wiki being resolved. The authors found that the "*wikis and weblogs we used proved to be reasonably usable*" and they considered that "*a number of relatively simple adjustments may have improved the usability of the environment for the students, and thus enabled better reflective work.*" This finding would support the earlier conclusion of Glasson and Lalik (1993) who identified that written dialogue generally promotes more reflection than purely spoken dialogue. However, Chen *et al* do not elaborate on the simple adjustments and leave unanswered their own question: "*What aspects of this software in particular… enable or impede the students' reflective work?*"

The technical features of a wiki suggest it can support the dialogue elements required of social constructivist pedagogy, both dialogue external to the students (discourse) and dialogue internal to the student (reflection). Further, with the growing use of wikis in industry and business, there is the scope for providing students with authentic activities. All three elements of social constructivist pedagogy — discourse, authentic activity and reflection — encourage student engagement with the activity. This in turn, as Dalsgaard (2006) suggests in his review, encourages students to become actively involved with the learning process rather than be passive recipients of 'knowledge'. There is, however, little conclusive research published on these topics in the context of a wiki-enabled collaborative activity. The papers cited above generally report results, not motivations. It will be a contribution of this research to address this deficiency through answering the research question; can a wiki enable a social constructivist activity?

This leads to the second research question:

Can a wiki enable a social constructivist activity?

2.5 Literature on the challenges of using a wiki

Klobas (2007) introduces many examples of communities of users who are united only through their use of a particular wiki web site. This would suggest that the challenges of using a wiki can be overcome and that a wiki can enable collaboration. A review of wiki directories would support this supposition. The largest directory, Wiki index (#WikiIndex) lists more than 3,500 wikis. However, wikis need not be successful. As Cole (2009) reports, it was not sufficient to say, *"If you build it [a wiki] they will use it."* Her third year undergraduates failed to engage with the provided wiki because of *"an unattractive course design."* For her students, the problem lay with the course, not the wiki. The papers discussed in this section focus on the challenges when using a wiki in a collaborative activity.

An unsuccessful wiki

Kennard (2007) reported disappointing uptake of a wiki. His study involved 25 postgraduate students studying for a Masters in Interactive Multimedia. He looked at one module, Digital Culture. This was taught without face-to-face sessions, all communication being via the internet. The module made use of a VLE, Moodle. The students came from a variety of backgrounds and several countries. They were divided into seven teams of three or four students in each and were asked to design a website. Kennard collected quantitative data only. The data included the number of wiki pages created, the number of forum posts and the number of forum posts relating to the wiki. From this Kennard identified that the "*levels of participation in the wiki were low*", and that there "*was a weak correlation between the overall number of forum posts and the number of wiki pages*". Without gathering other data, he goes on to speculate on the causes for his findings. He draws only what is recorded in the forums, such as requests for technical help in using the wiki. From this, he concludes that the students were unfamiliar with wiki technology and that they struggled with wiki page creation. These two conclusions were neither validated nor extended through interviews with the students. Instead, Kennard proposed future research to record Page History to reveal the number of interactions with each page by each student. He does not propose going beyond a quantitative metric, stating that the number of interactions "*may reveal how engaged a student became with the wiki*". Thus, we have a reported failure of students to use a wiki, but are no clearer as to the challenges they faced. Fortunately, other published papers are more forthcoming.

Klobas (2007) and other authors highlight that one of the main factors for successful wikis is a community of users who are committed to the wiki and continually update the content. The ability of students to form groups to support their online activities has been the subject of research reported in the published literature.

The benefits of socialisation

Salmon (2000; 2002) stresses the need for socialisation as an aid to student motivation to engage with the course materials and to sustain those engagements in cooperation with the other group members when participating in an online learning activity. It is through socialisation that the student is motivated to exploit the e-learning tool knowing that they are part of a larger community of learners. The importance of socialisation leading to communication is supported by Kiernan (2002) whose study of 21 new on-line moderators suggests, "*it is only after socialization occurs that information can be exchanged and lead to knowledge construction*". Kiernan's finding was reinforced by an empirical study of a further 19 new on-line moderators.

There are two aspects to socialisation as described by Salmon and Kiernan. The first is for the student to engage with the communication tool, in this research a wiki, and use it as a medium for social communication. The second is establishing membership of a group through gaining familiarity with the other group members. It is through these two aspects that a student gains commitment to the collaborative activity.

Attrition through lack of socialisation

Dutton *et al* (2002) compared several presentations of the same 'An Introduction to Programming in C++' course over several years. The course was available to undergraduate and post-graduate students. It was offered in both a traditional form with lectures and supervised labs, as well as a purely online form. Students could choose the course on which they enrolled. During course delivery, the online course suffered from higher attrition rates. Dutton *et al* reported that this was in part due to external non-academic pressures on the students, though indirect factors were identified too, particularly a sense of isolation. As Wheeler (2006) notes, students can feel socially isolated if they are geographically separated or studying during unsociable hours. However, these are often pre-existing factors in the students' life, and it is only through online technology that the student can follow the course at all. Wheeler reported that social isolation could be a significant barrier for some learners, and lead to a reduction in motivation normally derived from traditional, on-site education.

Wikis for socialisation

Augar *et al* (2004) studied the use of a wiki to aid socialisation at Australia's Deakin University. The wiki was used to provide an online ice-breaker session to help with students' online socialisation, preparatory to online group work using other tools later in the course. This much cited paper has some methodological issues but it is the only recently reported use of a wiki explicitly for socialisation in the context of the present research. The authors reported the wiki activity as successfully developing a sense of community among its participants. However, it is difficult to follow this conclusion from the data in the paper. Some 451 of the 538 registered students are claimed to have actively participated in the activity, but only 68% made posts in the wiki. There is no explanation of what 'actively participated' means in this context. In addition, while all students were encouraged to place photographs of themselves in the wiki, only 87 photographs were uploaded, and from the phrases used in the paper one may surmise that some students loaded more than one photograph. However, even if the exercise did not address the socialisation that Salmon suggests as necessary for a successful online activity, it can claim to have addressed her first concern of proving access because "*All participating students completed the exercise to a satisfactory standard, proving they could use the wiki in the process.*" So while the paper demonstrated that wikis could be "*used successfully to enable hundreds of students to participate in a collaborative icebreaker exercise*" and so use the wiki, the subsequent claims are not supported in their paper. This paper has been cited uncritically by other authors, for example by Naish (2006) in his introduction to wikis in learning. The Augar *et al* paper seems to have limited further discussion of the role of wiki-enabled ice-breakers. The present research looks at how students are introduced to wikis and follows up to look at how that introduction affected the students' use of the wiki and their engagement with the collaborative activities.

Other barriers to socialisation

Augar *et al* (2006) identified time as the main barrier to an authentic sense of community amongst learners. The authors found that while the 2004 and 2005 iterations of their research benefited from steadily improving reliability of the technology and the opportunities for authentic collaboration online, their students' attitudes to working in groups and socialising online did not improve significantly. Without elaborating, Augar *et al* state that it "*may not be possible to achieve an authentic web-based learning community in a university setting with a 13-week semester timetable.*" However, they record that students have been observed progressing from working as individuals to working in groups, and in some cases for the groups to begin to bond socially and form effective virtual teams. They state, "*an authentic web-based learning community remains a goal instead of a reality.*" They argue that the social bonding and extensive networking required to inspire feelings of membership in a community take time to foster. Since the present research investigates courses that last six months, Augar *et al*'s concern about time can be investigated further.

Student motivation by assessment

Augar *et al* raised another concern because their research indicated student participation in online group work was motivated primarily by assessment. Only a third of students participated in those exercises that were not assessed, as opposed to nearly 100% participation in the assessed task. If participation in online activities is motivated solely by assessment, they conclude that an authentic learning community cannot be fostered as a result. Their conclusion is outside the scope of the investigation in the present research because, as will be described in chapter 4, all wiki-enabled activities in this research are assessed.

Content security in wikis

A general concern for wiki users is succinctly described by Brain (2008) in his article introducing wikis to a lay audience. The open nature of a wiki and the ability to amend any content anonymously can be "*extremely disconcerting.*"

In an educational context Augar *et al* (2004) refer to the "*Possible problems faced when using wikis for e-learning include inappropriate posting of content and unintentional deletions.*" For Augar *et al* the solution to this lay in forming trusting groups of students through socialization. This solution is in line with conventional wiki practice in which the answer to problem posts and deletions lies in the community of users and *soft* *security*. Soft security is described as being "*like water. It bends under attack, only to rush in from all directions to fill the gaps*" (SoftSecurity, 2008). Soft security relies on the community of users to convince other people against attacking and to limit any damage the attacker might do: "*It works socially in offense to convince people to be friendly and to get out of the way of people adding value*" (SoftSecurity, 2008). For this to be effective, the object of the collaborative activity should be laudable, and the need of the community of users to meet that objective will override attempts at subversion. This seems to be effective for, as Ebersbach *et al* (2006) state, it *"has generally been observed that in wiki projects, destruction and/or damage remains relatively insignificant."* The sentiment should also apply in education.

There is one caveat noted in Chao (2007). Following a successful pilot of wikis used in undergraduate software engineering projects, he was planning for future wikis to be installed on a local server so that "*security concerns [can be] satisfied."* Unfortunately the issue is expanded upon in the paper. This suggests that using a simple wiki, with the open editing propounded by Ward Cunningham, may yet lead to student distrust of the wiki.

Another dimension of open editing and trust is explored by Gonzalez-Reinhart (2005) who argues in a state of the art review that open editing encourages participation through making the users feel empowered. Through open editing, students are being trusted not to act out of context or in a malicious manner. Gonzalez-Reinhart extends this principle to education when he highlights that trust is required in constructivist learning theory. In this theory, it is trust that enables the learner to express knowledge in order to construct it. Wagner (2004) echoes this concept in an introduction to wikis in education. However, neither author has followed up their ideas with empirical evidence.

The absence of structure or layout

Another consequence of open editing is the initial absence of structure or layout in a wiki. Gonzalez-Reinhart (2005) comments on how a wiki, through being flexible and unstructured, can be adapted to a changing working environment. Thus, as users gain a better understanding of what they want from the wiki, they can revise its internal structure to meet changing needs, and change their working methods to match. Rick *et al* (2002) report part of the wikis' success as a tool is the lack of structure. This functionality was intended by Ward Cunningham to permit the emergence of an optimum organisation within the wiki for the group using it. This approach was in contradiction to the prevailing practice of designing the structure of groupware software before release to the users. A consequence of the wiki approach however, is that there is no structure to guide users when first using the wiki.

The unstructured approach is not always followed when wikis are implemented in industry. Decker *et al* (2007) reports on the use of existing template documents in wikis when used to support requirements engineering. In this example, there is a clear precedent of established working practices, and the wiki is being used as a tool to implement those practices more easily than other tools could implement them. Hence, there is no need for working practices to emerge for they already exist.

A similar example is reported in education. Haake *et al* (2005) successfully used a template page that restricted what student could enter into the wiki. In their study, the students were writing reviews on papers and so a structure could be applied to their writing.

The absence or presence of a template suggests another potential challenge in wiki use, but one that is determined by the context of the collaborative activity. There appear to be no published reports focused on the consequences of wiki use in education without a template.

Alternative uses of a wiki

In the opening section of this chapter, mention was made of the use of a wiki as a Content Management System. This can lead to challenges arising from the student perception of the wiki.

Byron (2005) reports on a wiki's use as a CMS in a philosophy course teaching symbolic logic through distance learning to undergraduate students. In this situation, the wiki acts as a host for documents prepared using other software tools. The students downloaded a report written by one of their peers, edited it in Word[2] with Track Changes, and then uploaded it again. The students used the wiki as a document repository not as a writing tool. For many students this was a challenge to engaging with the activity because they objected to what they saw as extra work in sharing and reviewing the Word documents. Motivation was maintained solely by requiring the students to complete the activity. However, as Byron reports most did come to recognise the improved quality of the final version of their document when compared to the initial draft. He states that through this collaboration students learned to edit their own work and to review critically the work of others. Thus, the wiki enabled a form of shared learning by enabling students to see, and reflect on, the contributions of others, though the degree to which the students learned through this mechanism was not reported.

[2] Word, when used as noun in this dissertation, refers to Microsoft Word©.

In addition, Byron intended that the collaborative exercise would lead to dialogue among the students, but this did not happen. The design of the activity led them to focus solely on the immediate task, that of editing the document, not taking forwards the edits in open discussion.

Wiki as a repository

Augar *et al* (2006) reported a similar finding to that of Byron (2005) regarding students' attitudes to using a wiki as a repository. The students in Augar *et al*'s study had been the subject of an earlier paper (Augar *et al*, 2004) in which a wiki had been used as an ice-breaker activity to foster a sense of community among the students. In the earlier paper, the authors suggested that wikis had several features that could foster a sense of community but reported in the later paper that, "*Discussion activities using wikis have been met with limited success.*" Instead, the wiki had been used as a repository for students' individual writings. The authors attributed the students' use of the wiki as a repository to the students' familiarity with discussion boards. The students had established enough of a community among themselves to engage in discourse. However, the students expected discourse to take place in a discussion board.

One possibility, not mentioned by the authors, is that the students were already familiar with blogs. Their use of the wiki is identical to how content is managed in blogs. It is possible that the students found the wiki a match for their expectations for hosting content, even if the wiki did not match their expectations for hosting their discussions. Chong and Yamamoto (2005) identified a limitation in a wiki's support for discourse. Their conclusion was based on earlier work that identified wikis' strengths in supporting document creation through repeated editing. However, a wiki was less able to support discourse compared with dedicated tools such as forums. In consequence, the authors developed their own discourse tool, FlexNetDiscuss, to use alongside a wiki in the courses they taught. The small-scale pilot study with 24 undergraduates reported in their 2005 paper showed encouraging results from the combination of tools. This in turn suggests that wikis need not be looked on as the panacea proposed by Leuf and Cunningham, but as a tool with a specific role. This would fit in with practice in industry, such as that reported by Zeller (2007). He notes that in software engineering many tools are used, dedicated to specific tasks and that "*the set of tools makes up a greater whole*". Therefore, there appears to be a challenge in using wikis to support collaborative activities: where to host the supporting discussion?

The potential impact of unequal users

An alternative to supplementing the wiki with another tool is to designate someone to facilitate the discourse. This is counter to the original wiki philosophy of equal users, but could address the problems with discussion about the wiki content.

Coutinho and Bottentuit (2007) studied the wiki used as part of a Masters degree course in educational technology. They were disappointed that the students did not engage in learning *"through social interaction generated by the exchange and sharing of information and opinions among a peer group in an online learning community"*. There was little of the discourse among the students that the course designers wanted. This led the authors to postulate that a more active role by the students' tutor would have helped with the group discussions. Their follow up work, if any, has not been published. This leaves open the question of specific roles in a wiki-enabled collaborative activity.

Discourse through a wiki

Returning to the question of discourse, understanding its role in a wiki is important because discourse affects how a wiki can facilitate collaborative learning. Often wikis are used to facilitate collaboration in existing face-to-face courses. Bruns and

Humphreys (2005) describe their use of a wiki as an integral part of an undergraduate New Media Technologies course. In the course students created their own New Media Encyclopedia, M/Cyclopedia, modelled after Wikipedia. In putting learning into practice, the wiki seems to have been successful. Following this up, Bruns and Humphreys (2007) describe their experience of using a wiki to supplement lectures. The revised course was not a success. One issue was the lack of visual appeal of lecture notes in the wiki compared to the PowerPoint-based presentations the students were used to with other courses. This highlights the importance of the context of the collaborative activity in which the wiki is used. The authors had more success in using a wiki to supplement small group tutorials because the students did contribute. These included "*contributions from those class members who may be initially too shy to speak openly in class"* because the wiki gave those students a medium they could use to share their ideas without having to present them in the more public setting of a tutorial. This suggests a challenge the authors have successfully overcome.

Bruns and Humphreys used wikis to support existing class-based teaching. Their students had the option to meet face-to-face to progress their work. Distance-based education students do not have this option because all communication takes place online. This returns us the issue of tools that may be required to complement when online communication is the only medium available.

Complementing wikis in software engineering

In contrast to Louridas's (2006) all-in-one approach to supporting all aspect s of software engineering collaborative work with a wiki, Zeller's (2007) analysis of developing tools in software engineering practice suggests a need for multiple tools. Each tool would be selected and deployed according to its strengths. This view is developed by (Whitehead, 2007) who writing on the probable development of software engineering practice, argues of a growing need for a "*wiki-like system with a built-in notion of argumentation might be a useful way to collect and structure software system design rationale."* Whitehead expects there to be multiple tools as Zeller argues, but sees a role for a wiki to bind the tools together. These differing visions present a challenge to a course team when using a wiki in a software engineering course: exactly what tools will be required for authentic activity?

Extensions for a wiki

The central role of a wiki throughout a Requirements Engineering project is taken further by Ünalan *et al* (2008) who not only formalise the workflow, but provide an enhanced wiki with an implementation of the ReqMan framework (Olsson *et al*, 2005; Rech *et al*, 2007). However, Ünalan *et al* found that a "rich internet application" user interface was required to implement the desired enhanced features and even so, some could not be implemented at all. Arguably Ünalan *et al* validated Ward Cunningham's original choice of a simple interface, for in this example once one change was desired another change was needed, and so on. Similarly, Knauss *et al* (2009) sought to enhance a wiki to meet better the needs of requirements engineering projects. They too enhanced the wiki but found that "*close integration of task management is more important than rich features.*" They too found that organising the simple immediate tasks was more important than the sophistication of the wiki. A simple wiki, in an appropriate collaborative activity, could meet their needs. This is the final challenge considered in the literature review; will the same benefits of simplicity be true when applied to an authentic, collaborative learning activity?

This leads to the third research question:

What are the challenges in using a wiki in a social constructivist educational activity?

2.6 Chapter summary

Wikis originated in software engineering primarily to facilitate collaborative authoring of documentation. Industry recognises that wikis are good tools for use in software engineering, and their use has percolated through to software engineering education (Chao, 2007). Within software engineering in industry, wikis are finding a niche supporting requirements engineering because they are effective when used to collate requirements (Friske and John, 2007). There are as yet no published studies outside the current research and that of the research supervisors of wikis being used in RE education. The current research draws on successful examples from RE in industry to examine if the same success can be achieved when a wiki is used in an authentic activity in computer science education by asking:

1. Are wikis a usable medium for collaboration in an educational context?
2. Can a wiki enable a social constructivist activity?
3. What are the challenges in using a wiki in a social constructivist educational activity?

Conclusion

The opening section in this chapter defined a wiki. The subsequent three sections critically reviewed literature on three aspects of wikis relevant to this research, to define the three research questions given above.

The research investigates these questions to provide guidelines for others intending to use wikis in their collaborative learning activities. By extension, the research also identifies potential boundaries to the effective use of wikis, and how wikis might be supplemented with other tools. The research undertaken is an in-depth, multi-data study to elicit motivations as well as phenomena, which should enable the results to have wide applicability. This approach addresses a weakness in most sources cited in the literature because these sources are confined to small-scale studies so their authors often report limited reliability of the findings. The research presented in this dissertation does not have the same limitation.

Chapter 3 describes the approaches used to gather and analyse empirical data to answer the three research questions identified in this chapter.

Chapter 3 Choosing a methodology and identifying sources of data

3.1 Introduction

This chapter reports the data gathering and analysis process used to prepare this thesis. It explains the methods used and why they were chosen.

Chapter 2, Literature Review, described several small-scale studies that produced a variety of results in computer supported online group research. In most of those studies, no overarching framework or hypothesis was put forward. Neither were the proposed causal mechanisms for the reported results evaluated. This absence was often due to the lack of validity of the studies because of their small scale. This thesis addresses these deficiencies through an in-depth, multi-data empirical study to extract a view of a wiki-enabled collaborative activity with causal mechanisms for the reported results.

A three-stage approach to data gathering and analysis was followed:

- Inductive qualitative analysis of data gathered from the first Computing course presentation provided an understanding of the issues through a Grounded Theory inspired *in vivo* coding of emergent themes.
- Corroboration of emergent themes through a student survey, and tutor and student interviews, the structure of which were determined by the results of the inductive qualitative analysis.
- Review of the qualitative data, verified by quantitative data relating to wiki and course material access, was used to consolidate the emergent themes into the

concepts. Activity Theory assisted with aligning the individual's comments to aspects of the collaborative activities.

Section 3.2 discusses the epistemological background for the research and its influence on the choice of data analysis methods. This section includes an extended introduction to Activity Theory.

Section 3.3 documents the data sources and the data gathering methods. The section includes tables covering several topics including the data-gathering schedule, and the relationship between the initial data analysis and the chosen data sources and methods for the corroborative analysis.

Section 3.4 is a review of the data analysis tools and process, and Section 3.5 records the ethical approval process for the research to proceed. The chapter concludes with a consideration of the validity and reliability of the findings.

3.2 Epistemological background

The current research is fundamentally based on a positivist approach typical of information systems research (Mitev, 2000). This assumes there is an objective world, and that facts in that world can be conceived as correlations and associations between variables. Therefore, the aim of much information systems research, as well as this research, is to identify knowable variables.

When applied to research involving people however, the positivist approach is subject to the criticism that because human perception and understanding is fallible, the researcher cannot entirely determine knowable variables (Chalmers, 1999).

Constructivism, in contrast, is based on a person's internal understanding of the world and relies on the social construction of reality (Potter, 2006). This is the epistemology that informs the pedagogy of the courses studied in this research: the students are helped to construct their understanding of the course material through the social interactions enabled by the wiki. However, a pure constructivist approach to research can be criticised precisely because knowledge and truth are the result of perspective, hence all truths are relative to a specific context (Schwandt, 1994). This can lead to problems generalising the results of constructivist research because it is also necessary to ensure shared meaning. Yet meaning is a personal construct (Vygotsky, 1978).

The approach used in this research

The general inductive approach adopted in this research avoids the two possible problems identified above. The approach is intended to aid an understanding of meaning in the unstructured, qualitative data through the identification of summary categories from the data (Thomas, 2006).

Using inductive analysis, significant themes can emerge unbound by any restraints imposed by structured methodologies. In this, inductive qualitative analysis is similar to Grounded Theory (Glaser and Strauss, 1967). Grounded Theory does not pre-suppose a theory at the start of an investigation; for, as Strauss and Corbin (1998) summarise the approach: "*The researcher begins with an area of study and allows the theory to emerge from the data.*"

Strauss and Corbin (1998) stress that the methodology derives theory from a process of comparisons. The researcher constantly compares the emerging results with the existing results, searching for evidence to disprove those research findings and to support their conclusions. This differs from other qualitative methods in that the analysis is not structured by the method but comes out of a process of coding, conceptualisation and categorisation (Allan, 2003). This approach avoids the potential problem of a qualitative analysis that produces a description of what is observed, without providing an explanation.

Grounded Theory, though, is not without its problems. MacMillan and Koenig (2004) highlight that Grounded Theory is an ambiguous methodology that has deep internal divisions (Strübing, 2002). Therefore, in this research, the inductive principles of Grounded Theory are used solely to inform the analysis process.

When conducting a general inductive qualitative analysis, data is analysed through repeated close reading of the text to identify codes: significant themes within the text. Miles and Huberman (1994) discuss two methods of code creation. The first method they discuss is *in vivo* coding, in which the data is coded without *a priori* knowledge. This method is used in Grounded Theory (Glaser & Strauss, 1967) and permits codes to emerge from the data without restraint by the methodology. The second method uses a preconceived list into which the researcher aligns the emerging data. This list may expand or change through use. This method is more applicable when more is already known about the research topic.

Two-pass inductive qualitative analysis

In this research, both of the coding methods identified by Miles and Huberman (1994) are used. The initial data review, in the absence of any pre-conceived theory, is inspired by Grounded Theory and uses *in vivo* coding to permit codes to emerge. As will be described later in this chapter, *in vivo* coding was used on the online data (wikis and discussion tools) drawn form the courses. However, as codes emerged, and were refined and organised, so the corroborative inductive qualitative analysis on the interviews and surveys was conducted using the list of emergent codes and proposed categories.

While inductive analysis can assist in analysing the data drawn from individuals, this research is also concerned with the individual as an actor in a collaborative activity. Therefore, the activity needs be a unit of analysis in this research. To consolidate the individuals' views at the level of the activity, this research uses Activity Theory. The next sub-section provides an extended introduction to Activity Theory.

Activity theory

Activity Theory seeks to place the use of a tool within an activity into the social context of that activity. As the current research is concerned with a tool mediated activity in its entirety, including the social context, namely the use of a wiki to support collaborative learning activities, this suggests that Activity Theory has a role in this research.

Activity Theory, as developed by Engeström (1987) and Nardi (1996) originates with the socio-cultural theories of Vygotsky (1978), Leont'ev (1978) and other Soviet thinkers. The underlying assumption is that of the mediated action introduced by Vygotsky (1978). He stated that humans do not act directly with their environment; rather, they use tools and signs to mediate the actions. All actions in Activity Theory take place within a context, and are often impossible to understand without that context. Activity Theory uses *object*, meaning motivation, to include context in analysis. The minimal meaningful context for individual actions is the activity (Leont'ev, 1978). In Activity Theory, therefore, an activity is defined by its *object* or "motive" rather than its outcome because many activities may be required to achieve that *outcome*. The person, or persons, engaged in the activity are the *subjects*.

Engeström (1987) extended this idea to model activity systems, in which many people collaborate in the activity. He produced the enhanced triangular diagram shown in Figure 3-1 to include a social plane to record the social aspects of the activity.

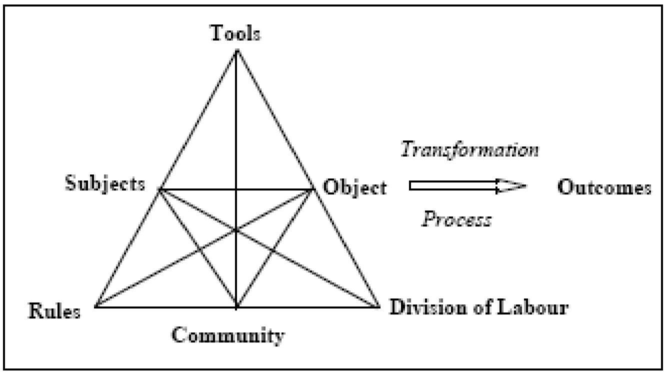

Figure 3-1: The Activity Triangle model or Activity System (Engeström, 1987)

The social context comprises three elements: the *Community* of stakeholders in the activity, the *Rules*, both explicit and implicit, by which they work, and the *Division of Labour* (a term betraying Activity Theory's Marxist heritage) that exists within the *Community*. In this study, the term *Roles* better describes what is intended by *Division of Labour*, allowing each subject to take on a role within the activity. The model also shows inter-connections between the nodes. These inter-connections are the sources of potential breakdowns in the realisation of the desired outcomes. Engeström's theory of expansive learning, or learning through participation in joint activities, involves collaborative questioning and analyzing existing practices to generate new possibilities. The breakdowns identified in the inter-connections are termed *contradictions* in Activity Theory. Thus, the model is intended to capture factors that hinder success as well as those that foster it.

Activity Theory is a theoretical framework. Scanlon and Issroff (2005), amongst others, found that it inspired their analysis, but was initially difficult to put into practice. However, Activity Theory has been successfully used to study information systems design and development (Kuutti 1999), to analyse work practices among teams in business, medicine and law (Engeström *et al*, 1999), to examine the evolution of work-based activities in corporate settings (Collis and Margaryan 2004) and to study students in higher education (Barab *et al*, 2004; Scanlon and Issroff, 2005).

Activity Theory does not include techniques and procedures to assist in its application (Barab *et al*, 2004). To minimise this problem the current research will adopt an operationalised form of Activity Theory: the Activity Oriented Design Method.

Activity Oriented Design Method

Activity Oriented Design Method (AODM) is claimed to be “most suitable for analysing human practices whereby several individuals are collaborating in carrying out mediated activity” (Mwanza, 2002). AODM has four methodological tools to provide the information relating to Engeström’s activity triangle nodes:

- Eight-Step-Model
- Activity Notation
- Generating Research Questions
- Mapping Operational Processes

The four tools are applied to interpret, model, and describe activities in a series of stages, where each stage leads to increasingly focused and refined observations. The tools support data gathering, analysis and reporting of findings. Each of the tools is described in more detail below.

The Eight-Step-Model

The first of the four tools operationalises the nodes of Engeström’s activity triangle model, by asking questions - one for each of Engeström’s nodes - of the activity system in a preferred order:

Step 1	Activity of interest	What sort of activity am I interested in?
Step 2	Object-ive[3]	Why is the activity taking place?
Step 3	Subjects	Who is involved in carrying out this activity?
Step 4	Tools	By what means are the subjects performing this activity?
Step 5	Rules and Regulations	Are there any cultural norms, rules or regulations governing the performance of this activity?
Step 6	Division of labour	Who is responsible for what, when carrying out this activity and how are the roles organised?
Step 7	Community	What is the environment in which this activity is carried out?
Step 8	Outcome	What is the desired Outcome from carrying out this activity?

In AODM, the Eight-Step-Model aids designers scope the new system. In this research, the Eight-Step-Model plays a similar, albeit retrospective, role. It is used in Chapter 4 to help understand and document the scope of the course teams' intentions for the collaborative learning activities in terms of Activity Theory.

[3] The use of a hyphen in *object-ive* is used in the conventional Activity Theory diagram to refer to an *object* when it refers to the motivation for the activity, rather than the *outcome* of the activity. Arguably, a better translation of the Russian is objective.

Activity Notation

AODM's second methodological tool facilitates the breakdown of the main activity system into smaller sub-activity triangles. The notation shown below assists the analysis:

Actors (Doers)	**~**	**Mediator**	**~**	**Object-ive (Purpose)**
Subjects	~	Tools	~	Object
Subjects	~	Rules	~	Object
Subjects	~	Division of Labour	~	Object
Community	~	Tools	~	Object
Community	~	Rules	~	Object
Community	~	Division of Labour	~	Object

This tool is intended to facilitate detailed analysis, breaking down complex activities into smaller, manageable units. In this research, the tool was used as intended to break down the students' use of the collaborative activities into smaller units of analysis. This assisted in the qualitative data analysis reported in Chapters 5, 6 and 7 providing sub-activities to guide the grouping of emergent codes into concepts.

Generating Research Questions

These 'Research Questions' are not be confused with the thesis research questions. In AODM, the term refers to a set of questions intended to guide the designer in generating system specific questions. The generic AODM research questions are:

1. What Tools do the Subjects use to achieve their Object-ive and how?
2. What Rules affect the way the Subjects achieve the Object-ive and how?

3. How does the Division of Labour influence the way the Subjects satisfy their Object-ive?
4. How do the Tools in use affect the way the Community achieves the Object-ive?
5. What Rules affect the way the Community satisfies their Object-ive and how?
6. How does the Division of Labour affect the way the Community achieves the Object-ive?

These six questions are intended to guide a system designer in generating system specific research questions. Applied to a retrospective study of a system as in this research, the questions lead to indicative codes and concepts that were mapped onto the actual codes from the inductive qualitative analysis.

Operational mapping

This tool is a means of mapping the processes and the relationships between sub-activity system components and identified contradictions. An example of one such sub-activity system is shown in Figure 3-2.

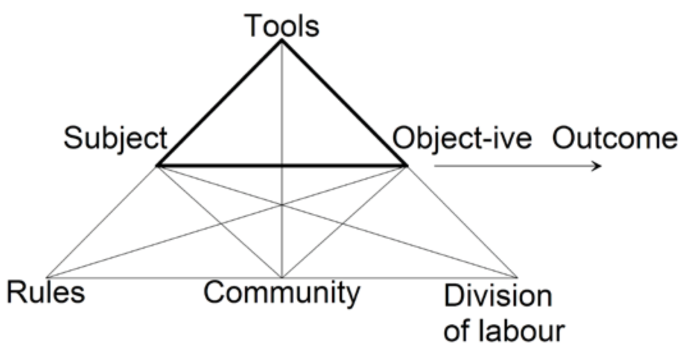

Figure 3-2: Focus on Subject—Tools—Object-ive sub-activity triangle

The Operational Mapping tool is a communication tool that draws on the findings produced by the previous three tools. The Operational Mapping tool is especially useful for highlighting any *contradictions* in a designed system through its sub-activity triangle diagram. It is used in this research in Chapter 8, where the findings from the analysis results for each of the three research questions are brought together.

Section summary

In this research, inductive qualitative analysis is the primary methodology for data analysis because it offers a process for breaking down the data through coding. As the codes are consolidated, concepts are revealed and from these categories are defined. This approach permits the researcher to go beyond the deduction of what happened, to expose the underlying concepts that led to the observations. These findings and the emergent concepts are reported in chapters 5, 6 and 7 relating directly to each of the three research questions. There are, however, potential weaknesses in Grounded Theory; in particular, the larger social context of the activity is not part of the analysis. However, Activity Theory can address this issue when in its operationalised form of AODM.

Having considered the background to the research, and the epistemology and methodologies to be adopted in it, the next section identifies appropriate data gathering methods.

3.3 Data gathering methods

This section describes and justifies the choice of data gathering methods used in this research. The research is not intended to prove a theory or to validate a framework; instead, looks at the use of a wiki to promote collaborative activities in distance education through identifying significant factors relating to wikis used to support the collaborative activities used in the teaching of Requirements Engineering (RE) and public sector management issues. Numerous authors (eg Cresswell, 2003; Fielding and Lee, 1993; Fraenkel and Wallen, 2006; Maiden and Rugg, 1996; Preece, 1994; Sapsford and Jupp, 1996) recommend qualitative methods as appropriate when a researcher does not know which factors are important to investigate. A review of the methods described by these authors and the methods applicability to the current research follows.

The primary data gathering 'method' used in this research was to download copies of the wikis and supporting discussions in FirstClass and VLE forums[4]. This forms the raw data for an inductive qualitative analysis. The data provides a means of establishing *what* the students had done. However, as discussed earlier, this data alone is unlikely to answer *why* the students had worked in the manner observed. Other data sources that can help address that question are now discussed.

Survey/questionnaire

This method is the one most cited in Chapter 2, Literature Review, and hence was selected as the primary data gathering method for this research. Survey covers a broad range of questions from highly structured investigations that have the advantage of standardised results to open questions with free format responses that offer richer feedback. Therefore, several survey instruments were considered to ensure a broad range of data was available for analysis.

[4] As will be explained in Chapter 4, FirstClass was the discussion tool used in the Computing course and the VLE forum was used in the Business course.

A concern when using surveys and questionnaires, often cited in the literature, is a low response rate resulting in insufficient data from which to draw conclusions. This problem was circumvented by taking data from the assignments written by the Computing students. That the assignment answers were a fruitful source of data arose from the fact that the Computing course team designed the course to encourage reflection by the students on the authentic activity in which they were engaged. Reflective questions were included in both the continuous assignments and final examination. This ensured an almost 100% response rate from all students who completed the course assessments.

The studies cited in the literature review mainly used retrospective surveys of students to gather data. This research uses two retrospective surveys at the end of each of two Computing course presentations.

The first retrospective survey was a standard Open University (OU) end of course survey that is particularly useful in assessing a students' response to a course and the teaching techniques incorporated into it (see Appendix 3.1). The second presentation of the Computing course was not followed with an OU end of course survey, so a research specific questionnaire was used instead (see Appendix 3.2). The two end of course surveys had a combination of pseudo-Likert and open questions, and were self-validating through cross-relating questions.

A retrospective survey of the Business course students was not possible because it would have led to the students taking part in too many surveys. The OU restricts the number of surveys students participate in to prevent undue demands on their time.

The answers to the survey and assignment questions form a major part of the data used in this research. An advantage of drawing the data from a variety of situations is that it enhances the reliability of the results through triangulation, comparing responses across the multiple sources.

Observation

Observation of participants has the advantage of passing beyond participants' perceptions and reported actions to seeing what they actually do. However, to counter the possible influence of the Hawthorne Effect – bias introduced by the observer or atypical alterations in participant behaviour caused by being observed – the methodology has to be supported by other methods to triangulate the results. However, in a distance-based course it is impractical to observe the students and tutors *in situ*. Therefore, this technique could not readily be accommodated in this research and so was not adopted.

It would have been possible to bring the students into our laboratories and observe them at work, but this could be seen to be an artificial situation and not helpful.

While observation was not used in this research, consideration of the technique did lead to the adoption of two other data gathering techniques to help triangulate the results. Firstly, if the students could not be observed directly, their output, the wikis and forum posts, could. Therefore, these data were collected and compared against the student and tutor statements. Secondly, the Virtual Learning Environment (VLE) logs of access records were collected to provide a quantitative measurement of tool use. This quantitative data would also serve to validate student and tutor statements of certain situations, such as the domination of a group by one individual.

Experiment

This method is not applicable to this research as experiments are intended to investigate a hypothesis by deliberately manipulating a situation. This research is exploratory, looking for significant factors, though it is possible that, having identified factors, they could form the basis for a post-thesis experiment to assess their impact further.

Simulation

This method is not applicable as the aim of this research is to gain an understanding of a situation. Without that understanding, no meaningful simulation can be created and tested.

Thus, several data gathering methods based on surveys and questionnaires were decided upon. However, they did not address the concern noted by Gephardt (1999) that in social research the cause of any correlations identified in the data may be missed. The prime method for eliciting them is the interview.

Interviews

Interviews provide greater flexibility than surveys and questionnaires in exploring issues. However, there is the potential for the researcher to influence the interview unduly – a problem with any data gathering exercise that relies on the researcher to interpret the data. To minimise this risk a degree of structuring is required in the interview. Hence, the interviews developed in this research followed a semi-structured approach. A set of core questions were devised and validated prior to any interview. The core questions would be asked of each interviewee and this common core of questions would reduce the possibility of the interviewer introducing bias, whilst still allowing the flexibility to explore other relevant issues as they arose. These issues could arise during the interview, or could be identified by the interviewer before the interview.

Alternative interview technique: laddering

Laddering is an interview technique widely used in Requirements Engineering. Laddering applies a structured process in an interview to elicit motivations, which suggests it would be an appropriate technique.

In laddering, each answer forms the next question, and until the question is answered, one cannot go further in this process. Laddering was developed by Hinkle (1965), a clinical psychologist, as a means of eliciting a clear understanding of a person's belief structures in a systematic way by replaying their answers as a question and thereby elicits underlying motivations. Laddering became established in psychology and spread from there to other fields with a similar need to understand a person's motivation, for example in market research, where it is used to investigate consumers' goals and values (Reynolds and Gutman, 1988). More recently, laddering has been used in knowledge acquisition and requirements engineering (Rugg & McGeorge, 2002). However, it has its limitations as acknowledged by Maiden and Rugg (1996), because circumstances other than attributes and values, e.g. time pressure or convenience, are neglected. Further, laddering assumes all knowledge is hierarchical, and Rugg (2003) suggests it is inadvisable to apply this technique when trying to elicit knowledge that is not hierarchically structured. In the current research, it was not clear that the interviews would be exploring hierarchical knowledge, ie views capable of formal representation. Hence, the decision was made to use the more flexible semi-structured approach. The semi-structured approach provides sufficient formality to ensure that a sufficient depth of questioning occurs, though without the constraints required by laddering.

The choice of mixed methods in this research

This research makes use of a mixture of data gathering methods. It draws on several qualitative methods to elicit the students and tutors' perceptions to enhance reliability of the findings. The findings were further corroborated through:

- qualitative data drawn from interviews and a student survey designed using input from a first review of the existing qualitative data
- quantitative data derived from the courses' VLE logs.

Table 3.1 shows the timing of data gathering during this research.

Table 3-1 Data gathering schedule

	Oct-06	Nov-06	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Jan-08	Feb-08	Mar-08	Apr-08	May-08
Computer course																				
Course team interviews	■						■	■							■					■
1st online data		■	■	■	■	■	■	■												
1st end of course survey								■												
1st course logs									■											
1st TMAs and examination scripts															■					
2nd online data								■	■	■	■	■	■	■						
2nd online tools survey														■						
2nd tutor interviews														■	■	■				
2nd student interviews														■	■	■				
2nd course logs														■						
2nd TMAs and examination scripts																				■
Business course																				
Course team interviews							■	■							■					
Tutor interviews														■		■				
Student interviews														■	■	■				
Online data								■	■	■	■	■	■	■						
Logs														■						

There is an extended consideration of the courses used in this research in Chapter 4.

Online data includes wiki content, as well as discussion content in FirstClass for the Computing course and in the VLE forum for the Business course.

Access to the Computing TMA and examinations scripts was only granted after the presentations' examination board had completed.

There were subsequent interviews with both course teams through to May 2010. The interviews followed up evolution of the courses through later presentations and discussed the applicability of the guidelines proposed in this dissertation to the courses.

After the completion of the first presentation of the Computing course, an initial inductive analysis was conducted on the qualitative data gathered. A series of data source discussion documents were prepared and reviewed with the supervisors. An important decision made as part of this review was to confine the scope of the research to post-graduate courses only.

There were two key outputs from the review: organising the analysis into three tiers and choice of subsequent data gathering methods. These are discussed in the next two sub-sections.

Organising the analysis into three tiers

Initially conceived of as research questions, these tiers are the building blocks towards using a wiki successfully to support collaborative activities.

The tiers emerged from a review of the phenomena identified in the early stages of the inductive analysis. The tiers were adopted to provide a higher level of organisation of the emergent concepts as the individual phenomena were consolidated into concepts.

The tiers are shown in Figure 3.3. They proved sufficiently useful as an organising hierarchy that they were used as the basis for the three chapters that report the findings of the data analysis.

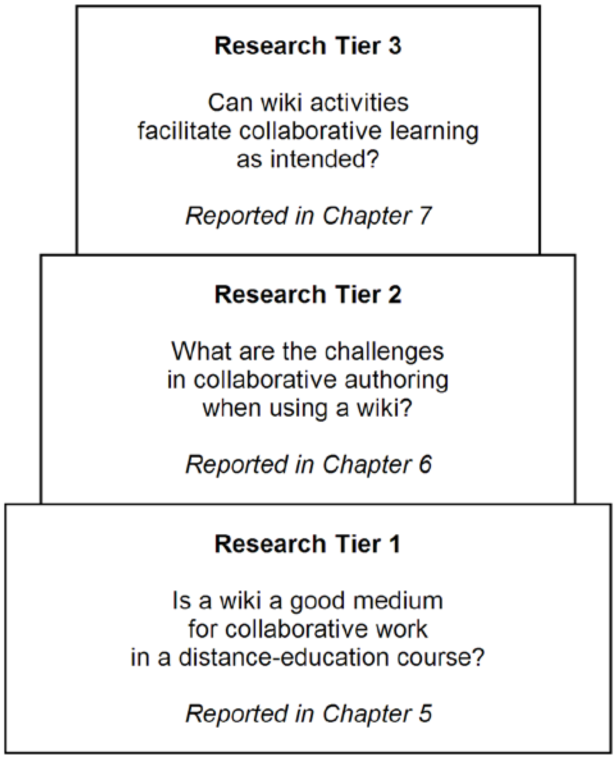

Figure 3-3 Three research tiers

Choice of subsequent data gathering methods

This sub-section contains the two tables produced as part of the review after the initial inductive analysis.

The review led to the addition of post-presentation surveys to the data gathering methods used. These surveys explore phenomena and enhance the reliability of the findings.

Table 3-2 shows how the aims of this research are achieved through breaking down the research into three tiers each with sub-questions. It was the necessity to answer the sub-questions identified in the review that informed the final choice of data sources. The table shows the sub-questions and the data sources.

Table 3-3 details the information to be gleaned from the chosen data sources, how it varies in the different data gathering exercises, and how it is applied to each research tier. In the table the research tiers are referred to in an abbreviated form as RT1, RT2 and RT3 respectively.

Supplementary information is provided in appendixes.

Appendix 3.3 details the development of the data gathering tools used in this research.

Appendix 3.4 details the implementation of the data gathering methods. This includes issues such as the recruitment of interviewees, which are subject to OU procedures.

Appendix 3.5 contains sample interview protocols covering both the Business and Computing courses

Table 3-2: Relating research question to aims and methods

Research tiers	Sub-questions	Data sources
1) Is a wiki a good medium for collaborative work in a distance-education course?	• What are the challenges that students mention when using a wiki to support collaborative work? • What makes for a 'good' medium? • Does the type of collaborative work influence the challenges?	• Semi-structured interviews with course teams, tutors and students • Wiki contents • Wiki statistics • Assignment answers • Examination answers • FirstClass and Forum entries • Post-presentation surveys
2) What are the challenges in collaborative authoring when using a wiki?	• How is the wiki used to support collaborative authoring? • What challenges do students report when using a wiki for collaborative authoring? • How are these challenges overcome? • What benefits do students report when using a wiki for collaborative authoring? • How are these benefits realised? • Does the type of document being authored influence the challenges and benefits? • What are the benefits of collaborative authoring	• Semi-structured interviews with course teams, tutors and students • Wiki contents • Assignment answers • FirstClass and Forum entries • Post-presentation surveys
3) Can wiki activities facilitate collaborative learning as intended by the course team?	• What is the intended collaborative learning? • How is this intention communicated? • Did the students follow the intentions? • What challenges do students report in using a wiki to support collaborative learning? • What benefits do students report in using a wiki to support collaborative learning?	• Semi-structured interviews with course teams, tutors and students • Wiki contents • FirstClass and Forum entries • Post-presentation surveys • Student marks

Table 3-3: Relating data sources to research tiers

Data Source	**Notes – Computing course**	**Notes – Business course**
Semi-structured interviews with course teams *Qualitative data*	To elicit course design and intentions for collaborative activity; overview on course delivery for later comparison to student reports, and additional examples for students not interviewed – RT1, RT2, RT3	Overview on course delivery (compare to student reports)– RT1, RT2, RT3
Semi-structured interviews with tutors *Qualitative data*	To provide an overview of the course design and intentions for collaborative activity – RT1, RT2, RT3. To provide an overview on students' collaborative activities to elicit examples of help/hindrance offered by wiki for later comparison to student reports, and to provide additional examples of student behaviours as observed by the tutors – RT1, RT2, RT3	To provide an overview on students' collaborative activities to elicit examples of help/hindrance offered by wiki for later comparison to student reports, and to provide additional examples of student behaviours as observed by the tutors– RT1, RT2, RT3 To record the tutors' role in the collaborative activities – RT2
Semi-structured interviews with students *Qualitative data*	To elicit views on wiki as a tool – RT1 To elicit views on collaborative activities – RT1, RT2 To elicit views on collaborative learning – RT3	
Wiki contents *Qualitative data*	To validate/substantiate other sources –RT1, RT2, RT3 To capture contributions to 'ice-breaker' activities – RT1	
	To capture student discussion on course concepts – RT3	Not applicable in the Business course
Wiki statistics *Quantitative data*	To confirm patterns of wiki use within groups (e.g. one dominant user or work shared) and by groups (e.g. simply placing individual content in the wiki, or editing and refining of content too) – RT1	
Assignment reflective answers *Qualitative data*	To elicit student perceptions of collaborative learning – RT3 To provide examples of wiki use – RT1, RT2, RT3	

Data Source	**Notes – Computing course**	**Notes – Business course**
Assignment other answers *Qualitative data*	To provide examples of student learning – RT3 To provide examples of wiki use - -RT1, RT2, RT3	
Examination answers *Qualitative data*	To elicit students' understanding of wiki in collaborative RE to aid learning – RT3 To elicit students' understanding of use of wiki as a tool – RT1	Reflective questions not incorporated into Business course TMAs
FirstClass entries (Dedicated online discussion tool) *Qualitative data*	To capture student discussion on the collaborative activities – RT1, RT2	First Class not used in Business course
Forum entries *Qualitative data*	Forum not used in Computing course	To capture student discussion on course concepts – RT3 To capture student discussion on collaborative activities – RT1, RT2
Post-presentation survey *Both qualitative and quantitative data*	19 Likert questions to add reliability to qualitative data - RT1, RT2, RT3 Supplementary qualitative data from open questions– RT1, RT2, RT3	Survey not used in Business course
Student marks *Quantitative data*	To represent a crude measure of students' learning – RT3	Student marks not available from Business course

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Summary of data gathered

This section summarises the quantities of data drawn from the courses analysed in subsequent chapters.

Two presentations of the Computing course (M883-06K and M883-07E) and one presentation of the Business course (B857-07E) were used in this research. The data gathering tools used are shown in Table 3-4.

Table 3-4: Data gathering tools related to course presentations

Data Gathering Tools	M883-06K	M883-07E	B857-07E
Semi-structured interviews with course team	✓	✓	✓
Semi-structured interviews with tutors	✓	✓	✓
Semi-structured interviews with students		✓	✓
Wiki contents	✓	✓	✓
Wiki statistics	✓	✓	✓
Assignment questions	✓	✓	
Assignment reflective questions	✓	✓	
Examination reflective questions	✓	✓	
FirstClass entries	✓	✓	
Forum entries			✓
Generic post-presentation survey	✓		✓
Specific post-presentation survey		✓	
Student marks	✓	✓	
Number of students	118	95	26

Table 3-5 details the quantities of each type of data gathered from the course presentations for use in this research.

Table 3-5: Data gathered related to course presentations

Data Gathered	M883-06K	M883-07E	B857-07E
Interviews	1	16	9
Assignment answers	117	252	
Final examination papers	118	78	
FirstClass posts	115	176	
Wiki websites	26	14	16
Wiki pages	147	65	0[5]
Forums			14

In addition, approximately 100,000 VLE log entries were recorded to determine actual use, as opposed to claimed use, of the wiki and supporting online facilities.

The next section of this chapter outlines the analysis process and is followed by a section describing the ethical approval process to authorise this research.

3.4 The data analysis process

This section opens with a description of the tools used to support the analysis, and continues with an outline of the process used to analyse the data. The analysis findings are reported later in the thesis.

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[5] Wiki pages is not an appropriate metric for the Business course because, as will be related in the data reporting chapters later, most groups used the wiki as a Content Management system to hold their report in Word format, rather than use the wiki itself to written the report.

NVivo

As the data used in this research is primarily qualitative, the main software tool used is a dedicated qualitative data analysis tool, NVivo. The tool allows raw data to be coded. See Appendix 3.6 for the emergent list of codes generated by this research. NVivo has additional features to assist in the collation and analysis of the codes. Other similar software tools were considered but none had the range of facilities and support available with NVivo.

The interview transcripts and responses, assignment answers, and survey answers were recorded in MS Word format, the wiki and forum contents were in HTML format, all of which could be imported into NVivo. However, the end of course examination answers were hand written and could not easily be converted into machine-readable format. Therefore, the scripts were coded manually, and the codes cross related to those in NVivo.

Excel

Microsoft Excel was used to process the statistics extracted from the VLE. The quantitative data used in this research was primarily intended to validate the qualitative statements and so triangulate the analysis. The researcher had previously used the statistical analysis tool, SPSS, for quantitative analysis, and did consider using it in this study. However, the level of statistical analysis required meant that Excel was sufficient for the task.

AODM

AODM does not have specific software tools to support its evaluation process. As the documents consist of prose, tables and diagrams, MS Word was used to record the data, assist the analysis and report the findings in line with the AODM process.

The analysis workflow

The numbered list below reports the analysis tasks in chronological order. The numbers are not significant, they simply document task order.

1. Initial interviews with Computing course team. Interview questions informed by Activity Theory. Course chair, without prompting from the researcher, used Activity Theory's nine nodes to formulate his description of the course and the intent for the collaborative activities. This was an early indication of the relevance of Activity Theory to this research. Output used in Chapter 4.

2. Data gathering (wikis and FirstClass) from 1st Computing course. Inductive qualitative analysis on data with systematic review and *in vivo* coding as data collected.

3. Data gathering (OU end of course survey) from 1st Computing course. Reading of relevant student open comments.

4. Data gathering (course logs) from 1st Computing course. Used later to corroborate some claimed problems with availability and stability of wikis. Also provided metrics for use of course materials.

5. Data gathering (wikis and discussion data) from 2nd Computing course and Business course. Inductive qualitative analysis on data with systematic review and *in vivo* coding as data collected.

6. Review of subsequent data gathering methods and scope of research. Outline three tier organisation derived. Interview and online survey designs derived from the existing results of the inductive qualitative analysis. Iterative development of interview scripts and survey with pilot runs before use in this research.

7. Data gathering (online survey, tutor and student interviews) from 2nd Computing course and Business course. Transcribed, systematically reviewed and coded as data collected. Independent coding checks and coding consistency checks conducted using this data.

8. Data gathering (course logs) from 2nd Computing course and Business course. Used later to corroborate patterns of use of wikis within groups. Also provided metrics for use of course materials.

9. Continued re-reading and coding of qualitative data, and consolidation of individual codes into categories. Each category representing a concept.

10. Data gathering (TMAs and examination scripts) from the two Computing course presentations. Note, the several month delay in gaining access to this data pending completion of the examination boards. Review of both datasets to apply existing codes and to identify new ones.

11. Continued revisions and refinement as a final stage of the analysis to confirm detail first indicated in the inductive qualitative analysis of the online data and corroborated by the surveys and interviews. Further categorisation of emergent individual codes, increasingly informed by use of Activity Theory. Activity Theory used to align concepts with research tiers.

Summary of analysis codes and categories

Codes were identified in the data during steps 2, 7, 9 and 10. There were 83 emergent codes, of which 47 covered positive aspects of wiki use and 36 negative aspects.

The codes were consolidated into concepts during steps 9 and 11. The codes were combined into 32 concepts:

- 16 concepts, discussed in Chapter 5, addressing research tier 1,
  Is a wiki a good medium for collaborative work in a distance-education course?
- 8 concepts, discussed in Chapter 6, addressing research tier 2,
  What are the challenges in collaborative authoring when using a wiki?
- 8 concepts, discussed in Chapter 7, addressing research tier 3,
  Can wiki activities facilitate collaborative learning as intended by the team?

3.5 Ethical approvals for conducting research

"The Open University is committed to high standards of professional conduct in all research activities. Central to the principles that guide research is that it must be conducted in accordance with the highest contemporary ethical standards." (#Ethics)

This section describes the application of these ethical standards to this research, and the approval of the data gathering techniques described in the previous section.

HPMEC approvals

The Human Participants and Materials Ethics Committee (HPMEC) produce a set of "Ethical Principles for Research involving Human Participants" (#Ethics_principles). These were followed in obtaining the necessary authorization for this research from the OU. This process included completing a 'triage' document (#Ethics_triage) which enables researchers to determine whether their study requires approval. The research reported in this dissertation did require approval because it involves 'human participants', namely students and staff of the OU.

SRPP Approvals

All research involving OU students has to be approved by the Student Research Project Panel (SRPP). The Panel's primary purpose is to co-ordinate research across the university so that students are not over-surveyed and researchers do not overlap in their demands. Only students approved by the SRPP may be approached to participate in research. Fortunately for this research, the restrictions applied by SRPP left sufficient students available within each course to produce a representative and meaningful sample, for example 87 out of 95 students on the second presentation of the Computing course.

The SRPP approval process requires that several supplementary documents be produced, including the 'Call for Volunteers' e-mail text, and a Consent form to record the interviewee's formal consent to participate in the research. These documents were prepared and approval was obtained.

Data Protection Act approvals

As some personal data is held about the participants in this research, such as home phone numbers, the requirements of the Data Protection (DP) Act apply in this research. The research is registered with the OU Data Protection officer and the individual electronic files are password protected and secured in accordance with the Act.

3.6 Quality, validity and reliability

Two concerns regarding the quality of any research are the validity and reliability of the results.

Validity is the ability of the research to achieve what it is intended to do. This is a particular concern for studies on the use of wikis in education for, as the literature review shows, many of the studies in this domain have been small scale and in specific circumstances. The most common methodology has been the interview, unsupported by any other data gathering method. Some of the published studies involved as few as six participants. The small sample size and single data gathering methodology calls into question the validity of the reported findings. The authors usually acknowledged this limitation and often stated that further research was required to expand upon their initial findings.

The current research is an in-depth, multi-data empirical study. It is based on the views of over 250 participants and the examination of over 50 wiki websites. The range of data sources and data gathering methods allow comparison of the views presented by the participants with the actual use made of the wikis, thus providing a valid assessment of the motivation behind the observed wiki use.

The quantity of data should also assist in ensuring the validity of the core findings. The large number of comparisons made between the expressed views and actual wiki use means the findings should be more generalisable.

Drawing data over two presentations of the Computing course further enhances the generalisability of the findings because the wiki changed slightly between presentations. This is described further in the next chapter on data sources, and shown in Figure 4-4: Availability of tools to courses.

Reliability is the ability of the research to provide consistent results. While validity is generally considered more important than reliability (because it is possible to reliably report invalid results; Cryer, 2000), to improve the reliability of this research's results similar data was collected from several cohorts of students. The repetitions drew data from two presentations of the Computing course that formed the core data for this research, as well as from a Business course to provide a contrast from a different domain. An advantage of drawing data over an extended period is that it includes the evolving nature of the tools used to support the collaborative learning activities. The changes in the tools are explained in Chapter 4 when describing the course collaborative activities. Thus, the data is drawn not only from different courses, but also from slightly different implementations of the tools in unchanged collaborative activities.

Three further techniques were used in this research to address the reliability findings. Additional data gathering methods provided different perspectives on the data and were used to confirm consistency of results through:

- triangulation within the research – a variety of data was collected and analysed, from different sources, and of different types to ensure consistency of the findings across the different views of the results;
- feedback from participants in the research – through discussion in the semi-structured interviews and the closing ‘Have you any questions for me?’ question in the interviews. Results are reported in Chapters 5, 6 and 7 as appropriate; and
- feedback from users of the research findings – through follow up interviews with the course teams after the core data gathering had completed. The interviews covered how the courses changed in later presentations and the applicability of the proposed guidelines. This is reported in Chapter 9.

In addition, procedures were adopted in this research to enhance the quality of the data gathering and analysis:

- independent coding check – through independent re-coding of ten sample texts;
- coding consistency check – through independent re-categorisation of ten sample texts using supplied codes; and
- pilot implementations of the semi-structured interviews and online survey – through their use by new members of the course team, supervisors, and OU technical personnel who had completed a previous presentation of the course.

Chapter 4, Course collaborative activities and course team intentions, describes the data sources in detail: identifying their similarities to ensure the reliability of the research, and highlighting their differences to illuminate the validity of the research.

3.7 Chapter summary

This chapter has described the data gathering and data analysis methods used in this research, and the suitability of the chosen data sources and methods. The methods, inductive qualitative analysis and AODM, were chosen in the light of the findings in the literature reviewed in Chapter 2 that this domain has no overarching framework or hypothesis. Rather there is a multiplicity of studies looking at particular aspects of wiki use. Therefore, this research does not set out to validate a framework or hypothesis, but to conduct an empirical study of wiki use and determine causal factors for the observed use.

This chapter opened with a section on the epistemological considerations for this research and the consequent choice of analytical methods to ensure transferable, causal factors were identified. The research uses inductive qualitative analysis, informed by practices from Grounded Theory, to elicit causal factors as well as phenomena. The research then uses Activity Theory to expand upon the social context of the activity, and to relate the emergent concepts to the role of the wiki as a tool in collaborative activities.

Section 3.3 looked at the choice of data gathering methods to support the epistemological considerations, and related the methods to the available data sources. A variety of methods were chosen, with qualitative data providing the primary data source and with both qualitative and quantitative data used for corroboration.

Section 3.4 outlined the analytical tools and process used in this research. The process followed a three-stage model of initial data collection and review, corroboration through review of data from other sources, followed by a comprehensive review of the complete data. This section was followed by a discussion of the ethical approval process to enable this research.

The final section considered the validity and reliability of the research and the steps taken to ensure the quality of both in this study.

The next chapter expands upon the data sources used in the research. It describes the two courses used in the research, and documents the collaborative activities and the course teams' intentions for them in the context of their courses.

Chapter 4 Course collaborative activities and course team intentions

4.1 Introduction

This chapter describes the collaborative activities designed by the course teams for two OU courses. The courses were *M883 Software Requirements for Business Systems* (http://tinyurl.com/2pke2k), referred to as the Computing course, and *B857 Current Issues in Public Management and Social Enterprise* (http://tinyurl.com/6njhtk), referred to as the Business course. The two courses used wiki-enabled collaborative authoring activities that had the potential for students to engage in collaborative learning that is the subject of this research. The courses were intended for post-graduate students and lasted six months. However, the courses were in different domains and had different motivations for including collaborative activities in their design. The information about each course and its collaborative activities was obtained from semi-structured interviews with the course team, and reference to course materials, such as the course guide and course calendar. Drawing data from two courses provided enriched data for comparison purposes.

The use of Activity Theory to describe the collaborative activities

As discussed in Chapter 3, this dissertation makes use of Activity Theory (AT) to provide a consistent description of the courses' application of wikis in their collaborative activities. To achieve this description, an operationalised form of AT, Activity Oriented Design Methodology (AODM), was used.

The initial task in AODM is to interpret the situation being examined in terms of the Activity Theory Model shown in Figure 4-1.

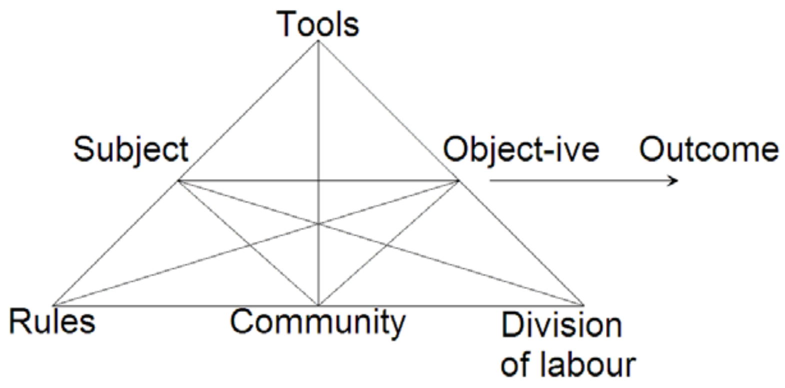

Figure 4-1: Engeström's Activity Theory model (Engeström, 1987)

In AODM, an Eight-Step-Model facilitates this process. Working through the questions of the Eight-Step-Model in the suggested order helps to define the several components of the activity triangle system. Through this process, "*general information about human practices and the kind of mediators that exist within the situation being examined is gathered*" (Mwanza, 2002). This provides the baseline information needed to achieve a valid analysis of the actual use of the online tools, including the wiki, by the students.

The Eight-Step-Model guided the design of semi-structured interviews used to elicit the course teams' intentions for the collaborative activities. Use of the Eight-Step-Model helped to interpret and communicate the course teams'[6] intentions for the collaborative activities. The hand drawn original models produced during the interviews are in Appendix 4.1. The models, as refined after the interviews, are shown in Figure 4-2 and Figure 4-3. The models helped identify the similarities and differences

[6] Course team – academics who define the course pedagogy and content. The course materials are developed by other OU specialists to meet the requirements of the course team.

in the courses' application of the wiki in the collaborative activities discussed in Section 4.4.

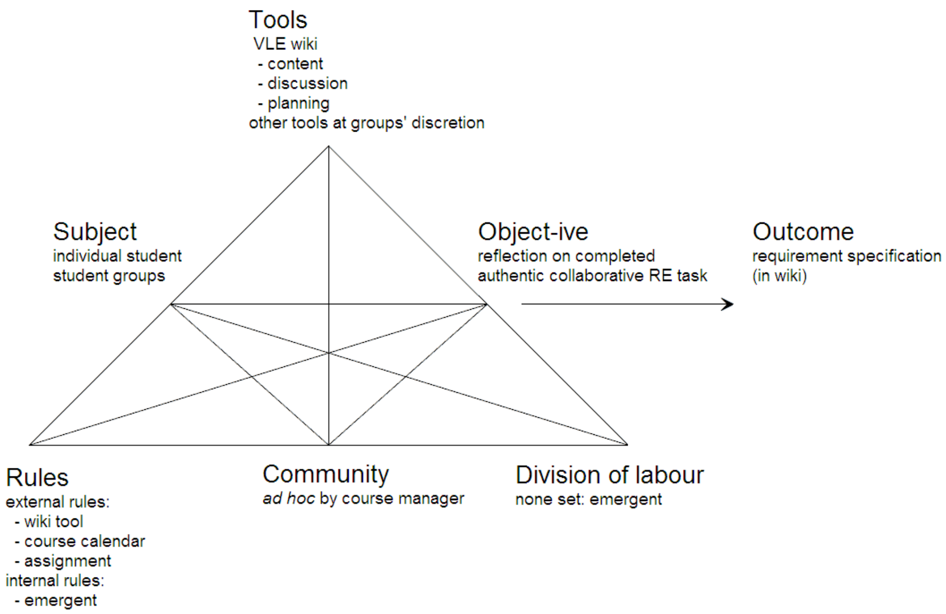

Figure 4-2: M883 course team intentions for the activity

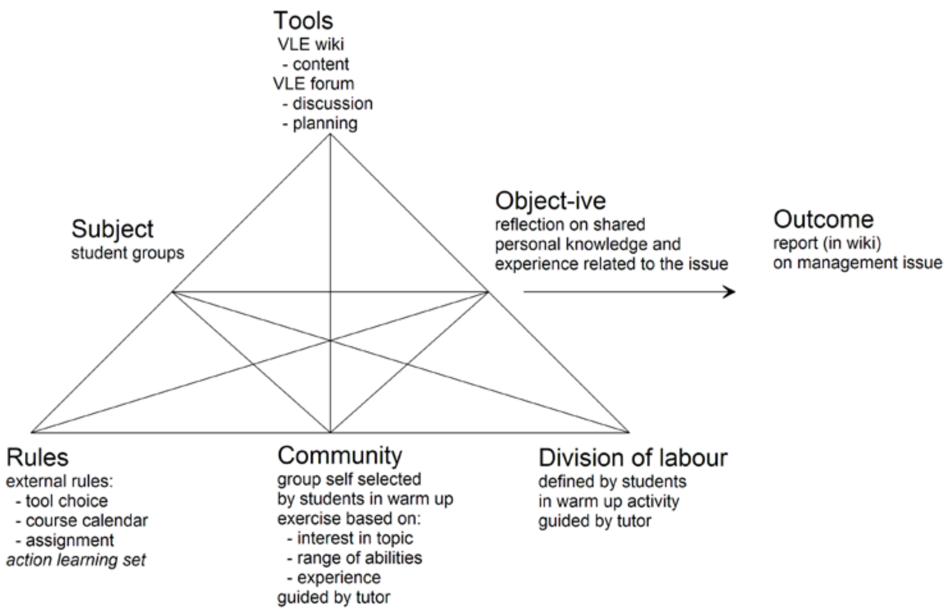

Figure 4-3: B857 course team intentions for the activity

Online communication tools available to the course teams

Before considering the courses and their collaborative activities in more detail, which forms the next two substantive sections of this chapter, this second part of the introduction discusses the tools available to the course teams during course development.

During the period of course development the online communication tools available to the course teams changed as illustrated in Figure 4-4.

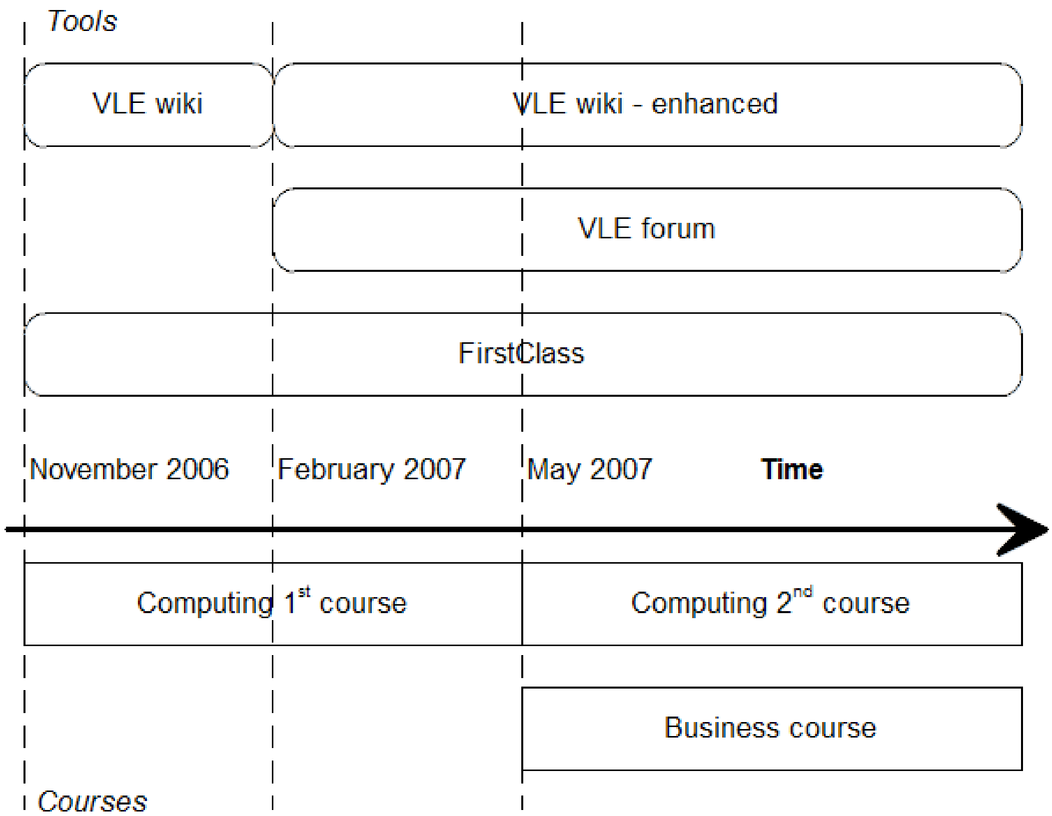

Figure 4-4: Availability of tools to courses

The initial release of the OU Virtual Learning Environment (VLE) in the summer of 2006 included a wiki for collaborative work. Prior to the VLE, course teams did not have access to a tool equivalent to the VLE's wiki. Some other course teams had adopted wikis from other sources. However, in the absence of a supported OU standard, the teams had to arrange their own implementation and support regimes for these wikis rather than rely on the OU's technical support facilities.

The course teams also had access to FirstClass, an asynchronous communication tool for threaded discussions that was the equivalent of the VLE's forum.

As will be related in Section 4.2 the Computing course team was looking to add a wiki-based collaborative activity to an existing course in time for the presentation starting in November 2006. The availability of the VLE wiki, with the minimal set up and support costs, made it a desirable choice. A version of the VLE wiki was released in October 2006, immediately prior to the start of the first presentation of the Computing course. This version of the VLE wiki was the original Moodle module customised to meet OU requirements, particularly with regard to access rights. The wiki was used in the first presentation of the Computing course studied in this research.

A major update of the VLE released in February 2007, as shown in Figure 4-4, included a wiki enhanced to solve various technical problems. The enhanced wiki was used in the two later course presentations studied in this research.

Among the many other changes that were incorporated in the February 2007 update to the VLE was the addition of a forum tool that fully matched FirstClass's functionality for asynchronous threaded discussions.

Several usability issues with the VLE editor, identified from experience with students, were also addressed with this release. However, the changes did not include additional functionality, such as support for the upload of images to the wiki website, the absence of which appears in the analysis reported later in this dissertation.

The remainder of this chapter describes the two courses and their collaborative activities.

4.2 The Computing course

The course, *M883 Software Requirements for Business Systems* (tinyurl.com/2pke2k), is a post-graduate course run by the Faculty of Mathematics, Computing and Technology. The course is intended to provide students with Requirement Engineering (RE) skills by giving them the means to analyse business problems in a systematic, comprehensive and accurate way. The approach adopted in the course encourages the students to think of solutions to business problems as products. The core of the course is about eliciting the requirements for such a product, and then recording those requirements so that they can be communicated, analysed, refined and implemented.

The course used in this study is one of the OU's suite of postgraduate computing courses. The students are usually studying for a postgraduate diploma or MSc in one of several areas in Computing, or a related degree programme such as Technology Management. A prerequisite for studying the course is that students must have the equivalent of a first degree and they are usually practitioners in a related area of Computing.

The course collaborative activity

Requirements elicitation and requirements specification are generally practiced collaboratively in teams as discussed in Chapter 2. The course team's aim in introducing collaborative activities in a wiki environment on the course was to emulate this developing practice in industry and commerce. The course's group work activity encourages students to:

- discuss a set of requirements;

- identify conflicts and ambiguities within the requirements;
- resolve the conflicts through discussions from the perspectives of different stakeholders; and
- produce an unambiguous requirements specification.

The collaborative activities also provide the opportunity for students to acquire transferable skills for group work and for using wikis and similar collaboration tools.

The course team intended that the students should benefit primarily from engaging with an authentic collaborative activity (Minocha and Thomas, 2007). This activity would allow the students to not only have the opportunity to engage in the RE process as taught in the course, but also be able to discuss their experience of RE and relate it to the course concepts. This opportunity for collaborative learning of the course concepts was considered by the course team to be a secondary benefit.

The course team wanted students to understand that the collaborative activities fitted within the pedagogy of the course. This was to ensure that students saw the wiki as an intrinsic part of the course and the RE process, and not as an additional tool that only added to the course workload.

The wiki and other course tools

The writing and refinement of the requirements in the collaborative activities was meant to take place within the wiki. The advantage of this approach was that all relevant discussion would occur in the wiki website as near as possible to the content; as the course chair described it, "*at least everything is in one place*". Therefore, the original wiki website had two pages, one for content and one for discussion, in a manner similar to Wikipedia (#Wikipedia). However, the students were free to choose other discussion tools with the agreement of their group.

In an interview with the course chair, it was clear that the course team had considered the use of other tools, such as First Class, to support discussion outside the wiki. FirstClass is an e-mail system specially written to support secondary and tertiary education (#FistClass). It was was already used in the Computing course for general discussion, and for contact between students and tutor. However, experience within the OU has shown that typically less than one-third of students use FirstClass on courses when it is used to support collaborative activities.

Another factor influencing the course team's decision to use the wiki for discussion was that FirstClass was not integrated into the VLE. Nor was the VLE alternative to FirstClass available for general use. The course team concluded that the advantages of independent, dedicated discussion tools were outweighed by the benefit of having discussion adjacent to content in the wiki.

Student guidance on using the wiki

A wiki is meant to be easy to use; a generally accepted advantage of wikis. This ease of use should benefit students because they to need spend relatively little time within their course learning how to use the wiki compared to the time required to learn to use other collaboration tools. To help the students learn how to use the wiki, two documents were available on the course website. The documents gave details on how to access and use the wiki. One was the generic *Moodle Wiki: Users Guide* written by the OU implementation and support team, and the other the course specific *How to use a wiki on M883* written by the course chair and the researcher.

In the first presentation of the course with 118 students, the *Moodle Wiki: Users Guide* was accessed 390 times, and *How to use a wiki on M883*, 401 times. On the second presentation, with 95 students, there were 221 and 202 accesses respectively.

As part of the first assignment, the students were given the opportunity to practice using the VLE on their own, prior to the start of the group activity.

The course team was aware of potential time pressures on their students and therefore the activities were designed to give the students the maximum possible time to complete them.

Role of the tutors

To minimise the impact on tutors, the student groups were self-managing. This was a pragmatic decision of the course team in designing the course, so that the tutors could "*concentrate on what their students think they've done, rather than making sure everyone is happy in the wiki*" (Course Chair).

The course team expected the students to have sufficient experience of group work, either from their previous studies or from their employment, so that they could conclude discussions and resolve differences themselves. A tutor was not required to moderate the students' work. The tutors were still available to students in their normal support role to address concerns and queries throughout the course.

Course organisation

At the time of writing, approximately 100 students take each presentation of the course. Each presentation lasts six months. The course schedule for the second presentation of the course used in this research is shown in Figure 4-5. As can be seen the calendar suggests dates by when students should have completed the collaborative activities necessary for the associated Tutor-Marked Assignment (TMA) submissions.

Study week	Start date	The set book Mastering the Requirements Process	Course text		Papers from course website	Assignments
1	May 5	Chapter 1	Volume 1	Study Guide 1	No	Suggested deadline for the wiki activity is **25 May 07**
2	May 12	Chapter 2		Study Guide 2	No	
3	May 19	Chapter 3		Study Guide 3	3	
4	May 26					**TMA01 1 June 07**
5	June 2	Chapter 4	Volume 2	Study Guide 4	1	
6	June 9	Chapter 5		Study Guide 5	1	
7	June 16					
8	June 23	Chapter 6	Volume 3	Study Guide 6	1	
9	June 30	Chapter 7		Study Guide 7	4	Suggested deadline for the wiki activity is **20 July 07**
10	July 7					
11	July 14	Chapter 8		Study Guide 8	2	
12	July 21					**TMA02 27 July 07**
13	July 28					
14	Aug 4	Chapter 9	Volume 4	Study Guide 9	No	
15	Aug 11	Chapter 10		Study Guide 10	2	
16	Aug 18					
17	Aug 25	Chapters 11 & 12	Volume 5	Study Guide 11 Study Guide 12	2 1	
18	Sept 1	Chapters 13 & 14	Volume 6	Study Guide 13 Study Guide 14	No 7	
19	Sept 8					
20	Sept 15	Residential Revision School				**TMA03 16 Sep 07**
21	Sept 22	Residential Revision School				
22	Sept 29	Revision				
23	Oct 6	Revision				
24	Oct 13	Revision				

Examination 8 – 19 October 2007

Revision School weekends will be held in September, confirmed dates will be provided at a later date.

Figure 4-5: Computing course calendar

The students were supported in their studies by a tutor. Tutors had about 18 students assigned to them. For the collaborative activities, the students were allocated to a group of about six students by the course manager. The course team chose this size of group based on their previous experience. This size allowed for non-participants within a group and for student attrition. Each tutor managed up to three groups.

Each wiki website was accessible only to its own group, their tutor and the course team. This arrangement was intended to assist with the formation of stable student groups and reduce the possibilities of plagiarism across groups.

Course assessment

The activities were tied to the course summative assessments: the TMAs. The course had three such assignments that followed the process for developing a requirements specification. The activities made use of a case study such as defining the requirements for a sports centre booking system. The students took on a role in the case study, whether as a software developer or requirements engineer; or as a user of the system such as a receptionist; or another stakeholder such as one of the sports centre members. To encourage participation, the students were assessed both on the quality of their contributions to the activities and on the quality of the jointly created requirements specification.

An advantage of the wiki is that it records all changes. This meant that students could report on their individual contribution to the collaborative activity using evidence from the wiki's history pages. This evidence can be verified by the tutor who assesses the students' work.

First assignment

As part of the first assignment, the students participated in an ice-breaker activity within their individual groups. The ice-breaker activity had two objectives:

- to familiarise students with the wiki; and
- to give the students an opportunity to introduce themselves to their fellow group members. (The Computing course does not provide the opportunity for students to meet face-to-face.)

Each student was asked to perform two tasks in the ice-breaker activity:

- add a small personal biography to the wiki; and

- choose a stakeholder type from a list of stakeholders in the case study and add a short biography for their chosen stakeholder.

The ice-breaker activity did not involve direct collaboration. The students did not interact in their tasks, and so no discussion was required.

Second assignment

The second assignment involved the students producing an agreed set of requirements. The first step in this activity required the students to populate their wiki website with a set of requirements. To avoid the problem of one student dominating a group's work, each student had to contribute three requirements they had devised for themselves. To avoid this leading to excessive duplication, the students posted requirements from the perspective of the actor they had chosen in the first assignment. The collaborative element of this activity involved discussing the resultant requirements to remove duplicates, conflicts and ambiguities. Thereby the students should produce an agreed set of unambiguous requirements for the system in the case study.

Third assignment

The collaborative activity in the third assignment involved each group checking the accuracy of the requirements developed in the second assignment and then specifying a fit-criterion (a quantified measure) for each requirement. The students were shown during the course that better quality fit-criteria are obtained by requirements engineers working collaboratively. This third activity emulates this real world process because the students have to agree on a set of fit-criteria for the requirements they developed in the second activity.

Each assignment included reflective questions to encourage the students to evaluate their experience with the RE process during the collaborative activities. To assist the students a *reflection template* containing some ‘trigger’ questions was provided, see Appendix 4.2. The template was devised by the course team in collaboration with the researcher. The students’ reflection was guided along three dimensions:

- on their experience of using the wiki as a tool;
- their personal views of the course and the role of collaboration in the course; and
- the role of collaboration in RE.

This course provided the researcher with a rich set of core data covering the range of wiki use from the ability of a wiki to support group work, through collaborative authoring to enabling collaborative learning in the context of requirements engineering.

4.3 The Business course

The Business course, *B857 Current Issues in Public Management and Social Enterprise* (http://tinyurl.com/6njhtk), is run by the OU Business School. It is one of two core courses in the OU’s Master of Public Administration (MPA) programme. The course is aimed at keeping professionals “*up to date with current debates and topics in and around the public and not-for-profit sectors*” (from the course guide).

Within the context of the MPA programme, the course is part of a progression of modes of learning that begin with highly structured individual activities and moves to more learner-designed investigations as students become more independent in their learning. Being a course towards the end of the programme, the Business course “*emphasises learning through researching, working collaboratively in teams to achieve agreed and negotiated objectives, undertaking peer review and responding to peer* *critique*" (from the course guide). The course team was particularly keen to include collaboration because "*we thought that one of the things in the MPA was the wealth of student experience which needed to be shared with each other*" (course team member). The intention was that the students would learn "*by comparing notes on the different ways that the same sorts of topics played out in different sorts of area*" (course team member).

The course team drew on the experience from the Computing course and from an OU project in Health and Social Care that used collaborative working to conclude that group work could lead to the following benefits to their students:

- collective learning;
- developing ideas together; and
- practice in discourse.

The course collaborative activity

The course team wanted to include a collaborative activity in the course because of the course's placement in the MPA programme. The team identified that the tool to support the collaborative activity had to include a mechanism for collaborative authoring and for the auditing of contributions. The course team specified five requirements for the collaboration and its output:

1. The report shall not be a linear structure. There is scope for a richer, hierarchical structure to the document.
2. The collaboration shall be performed on the same document with the ability to edit the document and revert to earlier drafts.
3. The students' work shall be auditable.

4. It shall be possible to ‘prove’ that an individual has contributed to the collaboration.

5. It shall be possible to ‘freeze’ the state of a report and then test it within an individual’s organisation.

It was while the course team was developing the technical specification for the course that the OU announced its VLE programme. On reviewing this announcement, the course team decided that the VLE’s wiki would meet the requirements for the collaboration and its output.

The wiki and other tools

The course team chose to support the wiki activities with the VLE’s forum. The team would have preferred students to comment on the content directly by links to each sentence, or even word, within the wiki but this facility was not available. They considered implementing a separate discussion page, adjacent to the relevant content page. However, from their own experience of piloting the wiki with five prospective tutors, the course team realised that the wiki as implemented did “*not lend itself to easy discussion*”. Therefore, they opted for the VLE’s forum, a conventional asynchronous, threaded discussion tool. This was chosen over the existing OU conferencing tool, FirstClass, because it was more readily accessible from within the VLE and had a similar user interface to the wiki. The VLE forum was sufficiently similar to FirstClass that the students did not require additional training to use it effectively though a brief guide was provided. The VLE forum was also used to support the general communication among students and their tutors.

Student guidance on using the wiki

The students were provided with the same generic OU VLE wiki guide as on the Computing course. The 26 students accessed the *Moodle Wiki: Users Guide* 151 times.

Role of the tutors

The tutors on the Business course had a more direct involvement in the collaborative activities than in the Computing course. This is described later in the subsection Course assessment later in this Chapter.

Course organisation

The Business course had fewer students than the Computing course. In the presentation of the Business course studied in this research there were 26 students. Two tutors were allocated to the course, and the students were divided evenly between them. Some of the students already knew each other as they had previously met at an optional weekend school, run as part of the MPA programme.

The course lasts for six months, the same duration as the Computing course. The course calendar is shown in Figure 4-6.

Using experience gained from the first presentation of the Computing course with collaborative activities, the Business course followed a similar pattern in its activities. There is an initial ice-breaker (the ‘Getting to know each other’ activity during week 2) and then two main collaborative activities tied into TMAs (the ‘Research and draft report’ activities during weeks 4 to 6 and weeks 13 to 15).

Study week	Date 2007	Individual activity	Learning set activity	Tutor group activity	Assessment and tutorials
1	1 May	Read Course Guide			
2	8 May			Online collaboration 1	Tutorial 1 (online)
3	15 May		Read position paper for issue 1 – allocate roles		
4	22 May		Research and draft report		
5	29 May		Research and draft report		
6	5 June		Finalise report		
7	12 June	Apply report			Complete part 1 of TMA 01
8	19 June	Apply report			
9	26 June	Prepare TMA			
10	3 July	Prepare TMA			TMA 01 due 6 July
11	10 July			Online collaboration 2	Tutorial 2 (online)
12	17 July		Read position paper for issue 1 – allocate roles		
13	24 July		Research and draft report		
14	31 July		Research and draft report		
15	7 Aug		Finalise report		
16	14 Aug	Apply report			Complete part 1 of TMA 02
17	21 Aug	Apply report			
18	28 Aug	Prepare TMA			
19	4 Sept	Prepare TMA			TMA 02 due 7 Sept
20	11 Sept				Tutorial 3 (online)
21	18 Sept	Individual work for ECA			
22	25 Sept	Individual work for ECA			
23	1 Oct	Individual work for ECA			
24	8 Oct				ECA due 8 October

Assessment strategy: Two summative tutor-marked assignments (TMAs) and an end-of-course assessment (ECA)

Figure 4-6: Business course calendar

Once the students had been allocated to a tutor, each tutor group completed the introductory ‘Getting to know each other’ activity. From experience with the pilot wiki, the course team decided not to adopt the freeform approach to the ice-breaker used in the Computing course, but to provide a quite detailed template for the students to support the ice-breaker activity. In the wiki, the students wrote a short biography and commented on three of their fellow students’ biographies. Based on this the students selected a research topic supported by their tutor. The students arranged themselves into working groups of five to six students to investigate the selected issue and to produce a report (further details are given below). Choosing the topics and agreeing the learning sets, as the student working groups are formally known, formed part of the students' learning about collaboration.

The first objective in the course's introductory activity was for the students to learn the tools they will use later in the course. The ice-breaker activity was intended:

- to help the students become "*familiar with the software that will be used to write, edit and publish your joint report*" (from the course guide); and
- to require the students to access the OU's electronic library and so help the student "*learn how to identify, evaluate and integrate information from various sources on each issue, and how to work collaboratively to prepare a good report on time*" (from the course guide).

The second objective of the ice-breaker activity was for the students to organise themselves for the main report writing activity that was to follow. The course guide directs the students to organise themselves into learning sets. Learning sets are small groups offering mutual support and encouragement to the participants as they actively probe and attempt to understand a problem. The Business School makes much use of group work in its courses, and so its students are introduced to concepts that use group work, such as 'learning sets', in other Business School courses. As the course guide states, *"learning sets are increasingly used in management both to address problems and to foster self-development by the managers"* and so the use of learning sets represented an authentic activity for the students. The course team intended the course to offer its students the opportunity to apply their previous introduction to learning sets and group work theory, to learn about group processes and collaboration.

Course assessment

The main activity, which forms the source for an assignment, asked the students to write a document collaboratively suitable for the senior staff of all of the organisations represented in their learning set. As with the Computing course, the Business course used assessment to encourage the students' participation in the collaborative activity. The course's two assignments immediately follow the completion of a collaborative activity. The course calendar, Figure 4-6, made this clear to the students. The calendar showed the assignment preparation as distinct tasks separate from the collaborative activities.

The course team intended that the two main collaborative activities should enable the students to learn to:

- use communication and information technologies proficiently in research, investigation, problem solving, group working and communication and the technologies would include information search tools and web-based collaboration tools such as wikis and forums;
- work in collaborative teams to achieve agreed and negotiated objectives; and
- achieve the above two benefits through collaborative working and personal reflection on practice and experience.

The students prepared a joint report on each issue and then individually related it to their own employing organisation or one they knew well. The joint report and the personal reflection relating the topic to their employment form two parts of the assignment.

The tutors were asked to assist in organising the students' learning sets. The consequent student groups were assigned to a tutor for the collaborative activity. The tutor took an active role in monitoring the wiki by providing advice and comments to the students.

Having completed the first activity, the students returned to their tutor groups and used the wiki to share their experiences of collaborative working and of the wiki. These experiences are attached in Appendix 4.3, and are discussed later in the thesis as part of the analysis of the student's use of the wikis.

The students then formed new learning sets to tackle a second issue. The brief, the process and the assignment question were identical in the two repetitions of the report writing collaborative activity.

The repetition was intended to allow the students to build on their experience of using a wiki and of group work from the first activity. This would allow the students to concentrate in the second activity on the research issue itself, and less on the technology and process.

Having completed the second activity, the students reformed into their tutor groups and used the wiki to share their experiences of collaborative working and of the wiki.

To enhance their students' learning experience, the course team arranged that, after the final assignment, the students' course wiki websites would be made read only and the previous access restrictions to learning sets would be removed. This enabled the students to read about the other management issues they had not covered.

The Business course provided a contrasting set of data that covers the same range of wiki use as the Computing course, with minor differences in the student expectations, tool options and organisation. To assist in documenting and understanding these similarities and differences, this research makes use of Activity Theory (AT), which is reported in the next section.

4.4 Comparison of course collaborative activities

As discussed in the Section 4.1, AODM's Eight-Step-Model was used provide a consistent description of the courses' application of wikis in their collaborative activities.

The Eight-Step-Model was used to guide the elicitation of the course team's intentions for the collaborative activities. The steps informed the design of the semi-structured interviews conducted with the course teams, and subsequent analysis of supplementary materials such as the course guides.

Table 4-1: Course comparison table

Eight-Step-Model	**Computing course**	**Business course**
Step 1 Activity of interest What sort of activity am I interested in?	• Collaborative creation of material for reflection and submission in assignment • Six month course	• Collaborative creation of material for reflection and submission in assignment • Six month course
Step 2 Object-ive Why is the activity taking place?	• To produce a set of requirements: informal presentation but must be unambiguous, without duplicates or conflicts	• To produce a management report on a selected current management issue: more formal presentation
Step 3 Subjects Who is involved in carrying out this activity?	• Post-graduate students • Student - works in groups with peers to produce requirements	• Post-graduate students • Student - works in groups with peers, guided by tutor, to produce report

Eight-Step-Model	**Computing course**	**Business course**
Step 4 Tools By what means are the subjects performing this activity?	• The VLE wiki is used for: - content creation - discussion of content - planning of activity • Other tools used at groups' discretion	• The VLE wiki is used for: - content creation • The VLE forum: - discussion of content - planning of activity
Step 5 Rules Are there any cultural norms, rules or regulation governing the performance of this activity?	• External rules: - use of wiki - course schedule - assignments • Internal rules: - none defined, emergent during the activities	• External rules: - use of wiki and forum - course schedule - assignments - work as learning sets • Internal rules: - defined by students during ice-breaker - emergent during the activities
Step 6 Division of labour Who is responsible for what, when carrying out this activity and how are the roles organised?	• None defined: emergent during the activities	• Defined by students during ice-breaker activity if group agrees roles are necessary • Tutor provides support
Step 7 Community What is the environment in which this activity is carried out?	• Course manager defined ad hoc student groups	• Self selected student groups • Group assigned to tutor
Step 8 Outcome What is the desired Outcome from carrying out this activity?	• Student has completed an authentic collaborative RE task	• Student has had the opportunity to share personal knowledge and experience

Table 4-1 shows the similarities and differences in the courses' application of the wiki in the collaborative activities.

The two courses were similar enough in structure and use of a wiki to provide comparable data, because both courses:

- were intended for post-graduates – similar students
- were of six months' duration – similar external constraint
- required authoring of a document collaboratively – similar activity
- expected collaborative reviews of the documents' contents with the intention that this should provide the students with the opportunity for collaborative learning as the students apply course concepts - similar benefit to the student
- used the produced collaborative document and subsequent personal reflection for assessment – similar motivation for the student.

Significant differences between the two courses emerged. The differences provided dimensions to inform the subsequent analysis reported in the later chapters of this dissertation. These differences were:

- choice of tools - the absence of supplementary tools in the Computing course against the use of the VLE forum for discussion in the Business course.
- support provided by the tutor - the greater involvement of the tutor in the Business course.
- group selection - the different methods of defining the student groups, externally imposed or self-defined.

- collaboration through sharing experience - the Computing course intended the students to share their experience of the new materials learnt in the course, whereas the Business course intended the students to share the experience they brought from outside the course.

The two courses with their similarities and differences enabled the research to realise Kuutti's (1996) claimed three contributions for Activity Theory referred to in Chapter 3:

- studying interaction embedded in social context
    - the courses have different social contexts, for example, the choice of group members and the role of the tutor.
- dealing with dynamics and development
    - the courses differ in their development of the collaborative activities: the Computing course takes the students through new aspects of collaboration as they first collate and then refine the requirements; the Business course has the students repeat the same collaborative activity but on a new topic, so the students have the opportunity to reinforce what they have learnt about collaboration and the wiki from the first iteration to the second iteration.
- multi-levelness
    - there was the expectation that the students would operate on different levels with the tasks that make up the collaborative activity because of their different skill sets. For example, there was the expectation that the Computing course students would be more familiar with a wiki as a tool. Consequently they could use the wiki

editor with less conscious effort than the Business course students. The opposite pattern might be expected with organising groups, because of their Masters programme the Business course students would have more experience than the Computing course students.

4.5 Chapter summary

This chapter has described the collaborative activities in the two courses analysed in this research. Both courses used a wiki to support collaborative activities that could lead to collaborative learning.

In this chapter we have seen that the collaborative activities in the courses were derived from different motivations of the course teams who designed the courses. The Computing course aimed at providing students with an authentic learning activity. The activity matches what the students will encounter in practice after completing the course. Through the need to write the requirements specification collaboratively the course team intended that students discuss course concepts too, thereby enabling the opportunity for collaborative learning by the students.

The Business course used the wiki primarily as a means of encouraging students to share their personal experience through writing about a topical management issue. The students collaborated to prepare a report on an issue. Individually they related the issue to their organisation or one they knew well. Thus, through sharing these different experiences and applying them to the topic in question, the students had the opportunity to learn collaboratively.

The courses are drawn from different domains and have several detailed differences that provide an informative contrast. These differences cover both the functional, eg should the wiki be supplemented by another tool, and the social, eg should the tutor have a larger supporting role. This informative contrast drawing data from two courses will enhance the validity of the research results.

This chapter has described the two courses and their collaborative activities that provided data, through the application of the methods identified in Chapter 3, to answer the research questions defined in Chapter 2. The next three chapters present the data gathered from these courses together with an analysis that extracts recurrent themes relating to various aspects of collaboration. Each of these chapters addresses one of the three research tiers identified in the initial inductive analysis.

Chapter 5 Collaborative group working using a wiki

5.1 Introduction

This chapter addresses the foundation tier of the analysis and assesses the ability of a wiki to support collaborative work in a distance-education course.

The chapter has three substantive sections. The first substantive section presents the results of the inductive qualitative analysis described in Chapter 3 related to collaborative working. The emergent codes are attached as Appendix 3.6. The analysis draws on student answers to TMA and examination questions, forum posts and wiki entries. The emergent concepts were refined in *post hoc* semi-structured interviews with students and staff from the second presentation of the Computing course and of the Business course, and in the open questions in the student attitudinal survey conducted after the second presentation of the Computing course. Sixteen concepts, collections of the emergent codes representing similar content, emerged from the analysis, and are identified in Section 5.3.

The inductive qualitative analysis showed that the wiki was broadly suitable for group working. However, the key features of a wiki, its simplicity and flexibility, did affect wiki use and meant that the students did not gain full advantage from the collaborative activity. The results of the analysis are summarised Table 5-2 in Section 5.4.

The second substantive section presents the quantitative results from the student attitudinal survey conducted after the second presentation of the Computing course. The survey provides a confirmatory overview of students' perceptions of the wiki as a tool to support their work in groups. The survey was described in Chapter 3, and is attached as Appendix 3.2.

The final section presents high-level conclusions drawn from the emergent concepts. A detailed consideration of the impact of the concepts, how they relate to the other tiers in the overall analysis and the issues identified in the literature review, is presented in Chapter 8.

5.2 Student and tutor comments on the use of a wiki to support group working

This section documents the qualitative comments on the wiki, drawing on multiple data sources. Most quotations in this section are taken from interview transcripts and answers to assignment and examination questions because they proved easier to work into the narrative of the chapter compared to, for example, extracts from a wiki.

The iterations of the inductive qualitative analysis were informed by the principles of Grounded Theory as described in Chapter 3, to uncover emergent themes for coding. The codes are documented in Appendix 3.6. The codes were then grouped into concepts guided by Activity Theory, as described in Chapter 3.

The sixteen concepts identified are:

1. The wiki as a tool
2. The use of the wiki
3. Knowing when the wiki content had been updated
4. The widespread use of e-mail
5. The place for discussion
6. Visibility of change
7. Distinguishing contributions within a wiki

8. The lack of inherent structure within a wiki
9. Student motivation
10. Student socialising and forming a coherent group
11. Maintaining a group
12. Strategic learning
13. Additional time constraints
14. Roles within the student groups
15. The role of the tutor
16. Establishing rules within the group

Each concept is now discussed in detail.

The wiki as a tool

That the wiki is intended to be a lightweight tool was identified by one interviewee only:

> *"seemed a very gentle thing on the hardware." [CS8 interview[7]]*

In the 196 examination answers (see chapter 3 for details) 8% of students mentioned that the wiki needed internet software only in order to be usable; 3% gave a variation on that answer by stating that special software was not needed on the client machines; and this student incorporated both aspects into his answer:

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[7] Quotations are identified by the following codes: CS, Computing Student; CT, Computing Tutor; BS, Business Student; and BT, Business Tutor, with a statement of the source.

> *"The wiki is an ideal medium for collaborative development work on a course like M883 because unlike other software packages that could of been used all that is needed is an internet connection and a compatible browser…" [CS7 examination answer]*

One student gave the more generalised answer that the wiki provided a "*low technological barrier to entry*" *[CS33 examination answer]*.

In contrast, some students suggested these attributes of a wiki were a problem: 8% cited dependency on the internet and a computer to be a weakness of wikis.

There are few other references to the technical aspects of the wiki in relation to its enabling of group work. Most students who had previous experience of wikis cited Wikipedia as their example (Computing students 1, 2, 4, 7 and others). Several of these students were not only readers but also contributors to Wikipedia.

While there were some examples of a direct positive statement:

> *"Despite some technical limitations with the implementation used by the Open University I feel that a wiki is generally a good medium for collaborative work on a course such as this." [Computing survey response 1]*

The overall impression was that, as a tool, the course wiki was not well received. The following opinion was provided by a tutor:

> *"There was a level of variety of different perspectives, because there would be some people who were used to information sharing, and information sharing systems, and they often weren't so keen on it, because they found it clunky." [CT7 interview]*

This concept is explored more fully when looking at the use of the wiki to support collaborative authoring because it was collaborative authoring that highlighted the deficiencies reported by students and tutors. This is particularly true of the experience of the Business School students and tutors.

The use of the wiki

There was a marked divide between the two courses regarding the use of the wiki. The Computing students generally described the wiki to be *"sufficient as it was"* [CS1 interview] and several commented in the survey on its ease of use. However, the Business students displayed a different attitude:

> *"It delayed our work significantly … [as we] had to find ways around the 'incomplete' technology" [BS1 interview]*

> *"It was not the most user-friendly tool and too often getting to grips with the technology consumed time and energy that should have been devoted to dealing with the course subject matter" [BS2 interview]*

The situation was summarised by a tutor who stated that:

> *"[it was] easy to get [to the wiki] but once there it was not intuitive to work with it" [BT2 interview]*

She contrasted this with the VLE forum, which was also a new tool:

> *"[the students were] perfectly comfortable with the forum" [BT2 interview]*

This could be because it was sufficiently similar to the FirstClass conferencing system with which the students were already familiar. As noted in Chapter 4, following a pilot, the VLE forum was enhanced to match FirstClass before release for use by students.

When asked about the wiki during the semi-structured interviews as a tool to help group work, many Business students were critical. A typical first answer was:

> *"not user friendly" [BS6 interview]*

Interview questions, designed to follow up this criticism, identified that the cause was not the wiki itself, but a mismatch between expectations and current wiki facilities. This concept is explored more fully in Chapter 6 on the collaborative authoring task where, as in the quote above, the underlying concern was the lack of support for pictures and diagrams that the students wished to use in their contribution to the document. However, the issue of this mismatch is relevant here because of the way it coloured the students' perceptions of the wiki:

> *"we all felt united in our irritation that the technology was not fit for purpose (couldn't add diagrams etc, so had to create a web page to put diagrams on there and make links)" [BS1 interview]*

The problem was exacerbated by poor use of the wiki, despite the provision of guides. Thus, one student complained about:

> *"the length of time it took to actually save the thing" [BS12 interview]*

However, this student was working on one wiki page several thousand lines long. When interviewed, the student was asked about his approach to using the wiki. His answer revealed that he was not aware of the benefits of dividing wiki pages into smaller units.

One interesting facet of conducting retrospective interviews emerged as demonstrated by one Business course student [BS5]. This student was vociferous during the course on the student forums and in e-mails to her tutor condemning the wiki. At no time during the interview did she raise the wiki as an issue. When specifically asked about the use of the wiki, she replied she had had time to reflect and accepted that it did provide an appropriate tool for the activity. During the course she was feeling the frustrations of using a new tool, though she reflected it was not the tool itself that was at fault but her knowledge of it and what it could be used for.

Another example of frustration is shown by this Computing student:

> *"I think some people are getting frustrated with the wiki early on because of course wiki's only there if people choose to go in and look at it. Whereas by sending e-mail it prompts people, so if what you're trying to do is drum up interest early in the process the wiki's no good, because people aren't going to go there and it will drop the interest." [CS7 interview]*

The issue of keeping track of changes in the wiki content was a recurring concept, mentioned by more than half of the interviewees. Though for some, it was only a temporary problem as their group adopted Microsoft Word for the collaborative authoring as will be described in the next chapter. However, it was a major source of frustration among group members and was the main reason for using other online tools to supplement the wiki.

Knowing when the wiki content had been updated

The usual solution to this problem, as cited for example by student B1 and her group, was to use e-mail to keep up to date. Students were familiar with looking at their e-mail daily, but not at checking the wiki daily:

> *"The wiki relies on everybody accessing it whereas email is something that gets read as part of normal life outside the Open University." [CS17 interview]*

However, not all groups agreed to implement this manual process, even though the problem was recognised, as was its potential impact on the assignment:

> *"The only disadvantage with it was that…because without actually going and looking at it, you didn't know whether anyone had updated, and it was almost down to you during those last couple of days of the assignment especially, you had to keep check back to see if somebody had posted something that you could respond to" [CS9 interview]*

> *"I feel obliged to check the WIKI regularly & attempt to comment on additions by others, whether this is the best way I can spend my few on-line hours whilst trying to study the course is debatable." [CS29 TMA answer]*

The provision of a facility to notify group members when the wiki was updated was suggested during and after the course by several students (two of the twenty in the Computing online tools survey, for example). For the most part, the suggestion was for this task to be handled by the wiki itself, though one student preferred to retain control:

> *"A facility to send an alert to other group members when changes have been made - one that a group member can fire off, rather than it being automated."*
> *[Computing survey response 1]*

However, in the absence of a notification facility within the wiki, groups used e-mail for their update alerts.

The widespread use of e-mail

E-mail was used to address the deficiency in the wiki that students were not informed of a change in the wiki content to which they had to respond. However, the use of e-mail was not without problems as shown by this wiki entry:

> *"I am posting this here too as it looks like some spam filters seem to block the invitations I sent by e-mail...*
> *So far I have got replies from Kxxxx and Ixxxxxxs." [CS24 wiki entry]*

Nonetheless, e-mail was widely used by all groups in the Computing course to supplement the wiki for as noted:

> *"And the other point is I think people just naturally tend to fall back to e-mail as the tool they're familiar with, and the tool they are used to using for discussion." [CS7 interview]*

The logical next step for these students was to move the discussion into the e-mails themselves. Two groups in the second Computing course did this, and then copied the e-mails into the wiki as a record. However, many group discussions and *ad hoc* e-mail conversations remained unrecorded. On questioning, the response was that the e-mails were still available to the participants in the discussion and there was no perceived benefit to copying the e-mails into the wiki.

The use of e-mail for discussions was not an issue for the Business course because a forum was created alongside each wiki to enable the groups' discussions.

> *"Well I guess you could say the front page made everything easily accessible for them - it was easy to find the wiki and forum - it was clear the difference between the wiki and the forum - so in that respect they found it quite helpful I think - but I*

must say that most of the conversation flows were through the forum" [BT2 interview]

This view was echoed by many Business students:

"Discussion threads [in a forum] were the most useful way of exploring individual issues and getting agreement on how to handle them in the collaborative reports. I didn't find the wiki particularly useful for this purpose." [BS11 interview]

"The discussion threads in the various fora were the most useful in terms of generating group discussion and advancing the collaborative work which had to be undertaken" [BS2 interview]

"I have to say that forums were/are much more vivid than wiki. Wiki is considered as a tool for creating something more permanent and not for day to day communication. From that point of view, group feeling is more expressed on forums." [BS3 interview]

The intention in the Computing course, as noted in Chapter 4, was for the discussion to take place in the wiki itself.

The place for discussion

In the second Computing course, discussion of the requirements took place in a variety of locations within the wiki websites:

- one group created their own page for discussion, leaving the supplied discussion page for the ice-breaker activity alone
- four groups used the supplied discussion page

- four groups embedded the discussion in the content page, but separated out the discussion from the requirements and provided a consolidated version of the requirements at the bottom of the page

- three groups embedded the discussion in the content page, but did not separate out the discussion and would repeat the whole revised requirement each time it was amended during the discussion – these three groups had very long pages as a consequence

- one group completed their discussion through FirstClass chat sessions and copied the log into their wiki content page – one student volunteered to act "*as secretary to write/amend wiki reqs with final decisions*" *[CS6 wiki entry]*

- and one group had no discussion visible in their wiki.

Overall, the Computing students did not like the wiki for discussions, with 21% commenting in their reflective assignment answers that discussion was difficult to follow in a wiki. As will be discussed later, following the thread in contributions can be difficult because the wiki does not of itself distinguish contributions:

> *"and it was then only after a little while if somebody else saying something that I realised that I'd missed something by going back up that I saw that someone had posted in amongst someone else's earlier posts, and it just meant that that got missed." [CS9 interview]*

In this context, it should be noted that the VLE forum used on the Business course was well received, and preferred by some to FirstClass:

> *"[with FirstClass entries] went completely out of date order, you didn't know which ones you'd read, which ones you hadn't read, and when you've got 40 e-mails on*

> *there… [the forum] was better in that it did tell you which one you haven't looked at… I think they were shaded weren't they?" [BS12 interview]*

Several groups scheduled synchronous sessions. Two groups in the second Computing course presentation used FirstClass for this and posted the log of the chat session into the wiki as a record (one group used this to discuss the requirements, the other to plan their work). This approach to record keeping had been suggested by the course team and tutors so that the students would have material to demonstrate their discussions in the assignments. These teams recognised the need to keep the discussion together with the material it referred to. During interview another Computing student came to the same conclusion when talking around this issue:

> *"Or should that [discussion] be on First Class, and then have a little First Class group for the discussion? Is that going to confuse everybody if it's in two separate places?" [CS4 interview]*

One of the reasons for the Computing course team wanting the discussion to take place in the wiki was to minimise confusion, to keep the discussion directly related to the content. However, this led to further problems owing to the simple nature of the wiki. Particularly how updates, and whether to content or discussion, were recorded.

Visibility of change

There was no mechanism in the wiki to point students to recent changes. The history page within the wiki was not helpful in this context. The history page information was too difficult to use for a student to determine what had changed with each edit because the student had to go to the appropriate history page for that edit, select the latest updated record(s), and then open each record to see what had changed. Then they would have to find the matching text in the wiki page because there was no direct link to it from the history page. All saved changes resulted in the creation of a timestamp in the history page and as one tutor noted:

> *"you only have to put one word in and you will get a timestamp - timestamps don't show the difference that is still an outstanding issue" [CT3 interview]*

All groups adopted the simple expedient of appending comments to the discussion, wherever the discussion was placed within the wiki, so that a thread like flow of contributions emerged. Occasionally, in a discussion a student would edit an existing comment and so broke this simple flow. However, there was no choice with content; it had to be modified in place:

> *"it was very difficult to see where you'd edited" [BS10 interview]*

> *"There's this issue of visibility of edits, the changes and things, how do you collaborate if you can't see what other people have done, and they can't see what you've done easily?" [CS8 interview]*

Distinguishing contributions within a wiki

The issue was compounded for many students because they were assessed based on their contributions. They wanted the contributions to be visible.

> *"couldn't make the comments look visibly different it was difficult to see who made what comment... even simple things like I'm red you're blue... proved difficult." [BT2 interview]*

> *"if you can make it in different colours for different contributions then you might have had a better chance [of seeing what had changed]" [BS10 interview]*

The usual solution was for the contributor to add a signature tag in the existing font. Most commonly this tag took the form of initials within angle brackets, and in the majority of cases accompanied by a date-stamp. However, even this simple measure was not without problems as seen by this tutor:

> *"noted confusion [was] caused by Axxxxx using <ART> as a tag in the wiki - everyone else mystified what this new HTML tag was" [CT3 interview]*

Where groups did not standardise on using initials as their signature, forenames were used instead.

This use of tags within discussions was effective once all students in the group were aware of the style. It was also suitable for the content of the Computing course collaborative document as it consisted of short, individual entries; however, it was not used in the long prose document required by the Business course. The Business course students did not distinguish their individual contributions to the report within the report. The solution there was to divide the report into sections, with an individual responsible for the initial draft of each; and then for them all to comment using the forum. This approach to collaborative authoring is explored in the next chapter.

The problem of attribution was sometimes compounded by the students themselves, as CS6 complained of his group: the group discussion took place in the content page rather than associated discussion page. This led to further confusion for him because discussion had to be separated from content. The inherent simplicity of a wiki that lead to the problem of distinguishing individual contributions also meant that discussion and content were indistinguishable. As noted above in the section 'The place for discussion', a variety of approaches were adopted by Computing course groups for co-coordinating discussion with content. Some groups placed the discussion directly with the content, while others had them on separate pages. That the groups could do this was due to the other special characteristic of a wiki as groupware: it is flexible.

The lack of inherent structure within a wiki

A wiki is deliberately flexible, it has no inherent structure. Its pages can be created and linked as easily as the content of the pages. This was frequently seen as a problem:

> *"The informal and easy-to-access style of the wiki made us a little careless in our writing I suppose. The result was very raw text, partly chat-type. Further input would be necessary in order to turn it into a real requirements document." [CS1 interview]*

The issue was known to the Computing course team. The team had provided a template for the ice-breaker activity during the first presentation of this course:

> *"Before attempting the assignment 1 wiki-activity, introduce yourself to your fellow students in the wiki group by providing the following information about yourself (type in your information at the bottom of the page):*
>
> - *Name*
> - *email address*
> - *phone number*
> - *brief biography"*

This advice was almost universally ignored by the students. Though one group did follow it directly, including the use of bullets, most adapted its key elements as headings either for direct answer or for prose sentences. In the second presentation, a similar pattern occurred with one group only using the template exactly including the bullets.

For the collaborative activities in the first presentation of the Computing course, only the overall structure of the wiki was given to the students. This consisted of four pages: one for the ice-breaker and any follow on discussion, and one for each of the three assignments. Thereafter, the groups could develop the wiki website as they chose. Most groups in this first presentation retained the provided structure though four developed multi-page sites: two provided a page per requirement, one a page per case study stakeholder, and one a page per course assignments criteria. However, following negative feedback, the course team provided more guidance in the second presentation and a template for recording the requirements as well as the discussion to refine them. This additional guidance was noted with approval by one tutor who worked on both presentations and thought the second:

> *"better as a template [was used] and more structure and discussions separated out - some students began to structure things themselves" [CT3 interview]*

However, not everyone appreciated the template:

> *"I think the wiki's efficiency as a tool was hindered by the template that we were given to complete" [CS1 interview]*

In the second presentation, of the 14 groups, six used the template, three used their own version of it, and five did not use it. Some groups had begun the collaborative work before the template was made available, and so chose not to rework their wiki, but two groups did rework their earlier contributions to the template format.

In the literature, and in Ward Cunningham's original design, a wiki's flexibility is intended to be an advantage. In the assignment answers, no students suggested that a wiki's lack of structure was an advantage, though 27% mentioned it as a disadvantage. This Computing student thought that:

> *"A wiki simply does not have the capabilities to ensure that these processes are applied in a consistent, secure way that supports structured, traceable development within a collaborative framework." [CS15 examination answer]*

The effect of the wiki's flexibility on workflow as well as content was noted in this Computing course survey response too:

> *"Thee [sic] free-form nature of wiki contribution did not provide any guidance through the process." [Computing survey response 10]*

However, a template alone was not sufficient:

> *"But once we'd got the template and we'd all agreed that was how it was going to be everybody was happy, but nobody would take that initial leap." [CS6 interview]*

In the Computing course, the students were provided with templates, both for the ice-breaker and the main collaborative activities, but not required to use them. Though their provision did lead one Computing student to reflect that the wiki could now:

> *"provide a lightweight approach to documentation – more powerful than office suites, but easier to use and more readily available than proprietary requirements engineering tools." [CS20 TMA answer]*

In contrast, the Business course ice-breaker and tutorial activity templates were highly structured from the outset and the contents were seeded by the tutors. This latter contribution seems to be the critical distinguishing factor in template use. From discussion with the two Business course tutors, their direct involvement in using the templates gave the students an example to follow in making their contributions, and so they followed the template. This direct involvement of a tutor can be considered a prescriptive approach to student engagement, and monitoring a student's motivation.

In contrast, the Computing course did not give the tutors this role, but offered greater indirect motivation for students to engage with the collaborative activities.

Student motivation

The Computing course team had addressed the issue of student motivation in the course design. The first assignment required a critical review of the use of wikis in industry to support collaborative work by requirements engineers. However, one tutor did consider that more guidance could have been given:

> *"…maybe we need a little bit more steer perhaps in the earlier TMAs[8] to get them and I think in some ways that is reflected in the TMAs that the level of commitment and involvement does go up assignment by assignment." [CT1 interview]*

This need for "*more steer*" was not recognised by the students. Indeed, some students were particularly self-motivated:

> *"As it happens, at work I really needed to know what wikis are about, so it was a very helpful experience to try them out in practice!" [Computing survey response 1]*

And on a personal level:

> *"There's a little bit of excitement when you open up the wiki and someone has put something on it." [CS1 interview]*

In contrast, the Business course had greater problems convincing students about the nature of the course:

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[8] TMA Tutor Marked Assignment, OU term for an assessment taken during the course, as distinct from an examination taken at the end of the course.

"Students were very resentful about the design of the course right from the word go. What am I paying for? I've got one thin book and a load of stuff on the whatsit and I've got to do all the research. Where's the beef? Kind of thing." [BT1 interview]

However:

"By the end [the students] were saying things, well some of them at least: I have learned; I have got insights I didn't have before; I've been able to see things from different perspectives." [BT1 interview]

In general, the Business course students did not engage with the wiki as a tool they would use at work. For them, it was there as part of the course:

"I accepted that it was part of the 'regime' which we had to work with and just got on with it." [BS2 interview]

"The wiki was only used to provide our final product – the report – especially once we realised its technical limitations." [BS3 interview]

Underlying this issue of attitudes to the wiki were the student expectations. The Business students were asked to write a report, and that meant producing a Microsoft Word document. This concept is explored more fully in the next chapter, where it is shown that this expectation played a significant role in determining how the Business students wrote their report.

Student socialising and forming a coherent group

Both the Computing and Business courses had ice-breaker activities. As discussed in the course design chapter, these activities had the dual intention of introducing the student to the wiki as well as to other students.

The wiki did not seem to influence the formation of a group:

> *"I suppose it's more how the people worked rather than the software itself." [BS10 interview]*

> *"A meeting or an online chat would have been better to establish the group." [CS1 interview]*

In the Computing course, the ice-breaker was a very simple activity with no interaction, simply the posting of a short biography. Even this limited activity was seen to be of benefit by some students:

> *"The others… posted their biographies… and I thought, 'oh very interesting'. We've got aeronautical engineers. We've got people who've done other courses. I'm looking forward to learning from them" [CS1 interview]*

In the Business course the students, in addition to posting their own biography, had to post three comments on their fellow students' biographies. This meant that:

> *"…people weren't so afraid to be questioning what somebody else had put in there." [BS12 interview]*

This additional task within the activity broke down the students' reluctance to edit other people's work far more quickly in the Business course, than in the Computing course.

> *"Even a chat page, … [where] people can chat about their favourite pop group or something. Just get to know each other, which you would, of course, in the real world as colleagues. You do chat to people at the coffee machine and get to know them." [CS4 interview]*

Only one group set up a chat page in their wiki so they could talk off topic. However, it was little used. Throughout all the presentations there was virtually no social chat. Generally this was cited as owing to time pressures (Business student S5); the students just wanted to get the assignments completed. Though one student did proffer another reason:

> *"We hadn't broken down a lot of barriers that were there, like getting to know each other. A lot of us were too scared to put the things down." [CS6 interview]*

However, the students, if not sociable, were typically very polite as this wiki extract shows:

> *"Jxxxxx: Well done all!! All resolved... I hope. :) Unless there's something significant we've missed then I think that's job done. Nice.*
>
> *Exxx: Thanks everyone for your organisation, input and discussion. Thank you Jxxxxx and Axxxx for finishing off the conclusions. Sorry I had to be elsewhere.*
>
> *Axxx: Grats! Thanks to everybody! It's a pleasure working with you! Now we can all move to the remaining questions in the assignment... :D" [CT3 group1 wiki]*

Overall, the groups did come together to work effectively. There were only two instances, both in the first Computing course, where groups failed to form and the tutor had to intervene. In the second Computing course, one group did not function as a group, as judged by the format of the wiki contributions and as confirmed by their tutor in interview. It is perhaps of note that none of the students from that group volunteered for interview.

The Business course was different to the Computing course in that the students could form new groups for the second collaborative activity. This was intended by the

Business course team to ensure that the students could research a topic of interest to them and, as the topic could change between activities, so should the groups. However, personal preferences also crept in:

> *"There was a slight change in personnel between the two groups, and I have to confess that Mr Negative that I mentioned, I deliberately made the effort not to be with him on the second go, because I just thought, 'I don't want to be dealing with this kind of negativity', and actually the second time round it was a lot better." [BS11 interview]*

This quote shows that one student, at least, valued the ability to choose their co-workers. In contrast, the Computing students who did not have this option as they were assigned to groups by the course manager, did not raise the issue of choice, but sought to build and maintain a group with the people they were assigned to work with.

Maintaining a group

Once established the groups did work effectively enough to produce the documents required by the assignments. The use of the OU standard group size helped in this respect as it avoided the problem of attrition, and of inactive group members as noted by this tutor:

> *"I've never had students who've contacted me and said, 'look I'm the only person here in the group'. I've had groups where maybe 2 or 3 out of 5 or 6 seem to do most of the work and then one or two sort of joined in at the very end for the assignment, but I've never been in the situation where I think one person did everything." [CT1 interview]*

The groups also survived the many demands made on the students by their lives outside the OU. An advantage cited for wikis is that it is a tool that can support non-collocated teams. In this research there were students whose work took them to Australia, Belgium, Germany, Ukraine and the United States during the course, as well as students who resided abroad.

In the Computing course assignment answers, 64% of students mentioned that the ability to support geographically separated contributors was an advantage of wikis. Two benefits arising from this advantage were identified:

18% mentioned the project benefit that the contributors did not have to come together in the same place at the same time so avoiding scheduling clashes, transport costs, and other overheads

16 % mentioned the personal benefit that the contributors could work at the time and place of their choosing.

The latter benefit was of particular importance to many of the students on both courses as it was one of the factors that influenced their decision to study with the OU. They wanted the flexibility offered by distance education as set out by these tutors:

> *"In the Open University a student tries to adapt, to integrate their study with their life, and then we interfere in that because we are giving them deadlines. We are forcing them to collaborate on certain dates… it goes against… the openness and flexibility of the Open University, because if they wanted to do a full-time course they join a normal university. …For example in the last presentation all my students were in full-time employment, and more than a couple of them were married with children, so you can see how they have to juggle and accommodate a course to their life. They are not accommodating their life to the course you see." [CT4 interview]*

"All my students seem to be either in full-time work, and have particular work pressures, or are not in full-time work possibly because they're at home and taking a career break, and looking after kids or looking after an aging relative… so they have quite a lot of time pressures." [CT7 interview]

And as expressed by these two students:

"It is anticipated when undertaking an OU course, there is inherent flexibility within the programme to fit study around other commitments, in opposition to the inclusion of a fixed-time activity of this type." [CS30 TMA answer]

"One main benefit of OU courses is to be able to work when you want. The wiki activities in M883 [the Course] undermined this." [CS31 TMA answer]

The nature of the students recruited to OU courses meant that they were vulnerable to outside time pressures.

Time constraints were reported by students as a major influence on their decision to adopt a strategic approach to learning.

"Always the [hardest] part of it is finding the time to do it." [CS3 answer]

Strategic learning

Discussion did not always happen to the depth desired by the course teams because of strategic learning on the part of the students.

Entwistle (1981) documented a variety of approaches to learning that students might adopt. The social constructivist pedagogy of the courses in the current research expect students to adopt a deep learning approach. Deep learning means that students focus on what is significant in the course materials, relate their existing knowledge to the new materials and relate the theoretical ideas to practical experience. In contrast, in surface learning students aim to memorise only those parts of the course required for assessment, with no attempt to reflect on the material. Surface learning seems to be more likely when learning is isolated from practice (Lave and Wenger, 1991) and hence, in part, social constructivism's call for authentic activities.

Strategic learning is a refinement of surface learning, in which the student will do whatever is needed to gain good marks, but will not engage with the course material (Entwistle and Ramsden, 1983). Hence a student adopting a strategic approach may fail to engage with the collaborative learning and so cannot benefit from the wiki-enabled collaborative learning activity provided for them.

One Computing course student explicitly stated that he was only taking the course to complete his Post-graduate Diploma. Other examples of this attitude were reported by Computing tutors:

> *"there are an awful lot of people who are satisfied… to get the pass towards their diploma" [CT7 interview]*

> *"[some students] were almost dropping in at the last minute to see what they could pick up or do enough to get themselves pass marks" [CT1 interview]*

The level of commitment was recognised as being the student's choice:

> *"There were the students who were very committed who put in, and many more others who did less" [CT1 interview]*

Though that did not make it any easier for the tutor who was not meant to intervene in such circumstances:

"I just feel a bit guilty in some ways that I left them to it" [CT1 interview]

Additional time constraints

The demands on a student's time became a particular issue as the introduction of the collaborative activities effectively increased the number of deadlines within the course. This meant students had less scope to manage their private lives to meet the workload peaks and troughs of study:

"[In] assignment 2 there was a deadline which was the assignment deadline, but in fact I think there were actually 3 deadlines,[because] you had to contribute a set of requirements by a certain date, then you had to provide feedback on those requirements and have a discussion, and then you need to finalise a set of requirements, and that needed to be put in your assignment." [CS3 interview]

Other students saw their schedule as having additional deadlines:

"It's timing mainly. There's two different tasks we need to do. We need to get the requirements up and then to process them." [CS7 interview]

This issue was complicated by the locking problems in the version of the wiki then in use:

"Towards the very last days of the exercise it became difficult to add one's input as everyone seemed to be online commenting each others' contribution, making the wiki page 'reserved' almost constantly. In work/professional environment this probably wouldn't matter so much as most people usually work more or less set hours and then go home. But most people in our group were part-time students, meaning that collaborative activities had to be balanced and scheduled very

carefully with work and private life – at times I didn't manage to save my input into the wiki until it seemed to be too late." [CS1 interview]

Especially as there was the need to allow the time for others to contribute:

"and this is a problem with wiki it's not a fast interactive tool, and some people won't be comfortable with communicating that way." [CS4 interview]

For some students the additional demands and consequent loss of flexibility proved too much, such as this from the first Computing course reported by a tutor:

"There was one student [who] got really annoyed… and said well, 'if that's what you want to do, it's not that I'm against it, but it's no longer for me 'cos I don't have the freedom that I did before'." [CT1 interview]

Other students were de-motivated to a less dramatic extent, though still to the detriment of their, and their group's, work:

"You know somebody would come along and enter a couple of requirements, and then they might come back two days later and find nobody's added anything or commented anything, and they kind of give up in disgust and go away for a week." [CT7 interview]

However, some students recognised that the problem of time management within the activity could be ameliorated by the right organisation, especially if someone could co-ordinate the contributions and their timing.

Roles within the student groups

Generally roles were not formalised, even when the benefits of some organisation were recognised, especially at a project manager level:

"Our group didn't appoint anyone to chair the discussions or to summarise the changes, and as the wiki page became longer and longer it was more and more difficult to see who had said what and when, and what were the open questions." [CS1 interview]

"With several different contributors, it also becomes apparent about the level of organisation required. Co-ordinating different people's comments and inputs require a lot of effort – which was one failure of the Wiki group I was a member of; mainly we did not agree our approach at first. This really highlights the need to have an overall co-ordinator / manager of the Wiki." [CS3 interview]]

"I think if we'd had a project manager it would have worked better." [CS6 interview]

"The danger of being too committee based with a never ending spiral of discussion has to weighed with the need to produce a requirements set within a useful timescale. For any group working a consensus has to be reached or somebody has to act a 'moderator' to move the process onwards." [CS39 TMA answer]

Though as one Computing student noted:

"…you could argue that we're going beyond what a requirements engineer has to do now. If this was a Project Management course it might make more sense." [CS4 interview]

Generally in the Computing course students were not willing to take charge of their group in a project management role; though there were two roles that students did adopt. The first role was to initiate planning, much as a project manager would, but without following through to manage the agreement, as in this example from a wiki post:

"Can I suggest that we get all the initial requirements posted by the end of Sun 15th July so that we've got a few days to analyse the requirements before the suggested 20th July deadline? Axxxx" [CT3 group 1 wiki]

The second exception was an editor role, taken up by several students:

"OK everyone, I've set up the framework for our final answer and added Fxxxx's contribution. Mxxxxxx" [CT3 group 1 wiki]

"I have added a consolidated requirements section at the end for the output of the analysis, with two exceptions." [CT5 group 1 wiki]

The Business students, in contrast, saw the need for roles earlier:

"A good division of research work and writing helped us to avoid difficulties." [BS3 interview]

The general opinion of Business students was that they were effective in agreeing roles for themselves, especially on the second iteration of the collaborative activity as they knew the importance of roles by then (Business student 6) and further illustrated by this comment that the work on the second report went more smoothly than the first one:

"…because we were a lot more organised when we came to the second one, because we knew how to work the group, and who would take responsibility for what, and we sorted that out much, much earlier on the second time." [BS12 interview]

The realisation that defined roles could benefit the group was most clearly seen in the assertive actions of students BS4, BS20 and BS26 who sent out forum messages to their groups with a proposed timetable for the work and a request for information on people's skills so that roles could be assigned. BS10 assumed the role of project manager for his group:

> *"So I did all the project management and actually put the whole thing in the wiki, so it wasn't just that we had the essay itself, and the comments on the essays and all the rest of it. We also had the whole project plan of when people had to do things and people had to do them, and when they had to do it." [BS10 interview]*

He found using the wiki beneficial for project management:

> *"So what I said was 'here's the project plan, [and] put it in wiki… So I think its quite a useful tool in that sense, not just the essay sense, but actually a way of saying 'here's a way of doing something' or 'here's some things' as a way to sharing out tasks. Now can you go away, and you know you choose how much you want to put in or not?" [BS10 interview]*

Thus, the wiki was used to enable discussion on the process of collaboration, not just on the product of the collaboration. This student benefitted from the experience of using a wiki in the Business course and how it can assist with task assignment and management, which was not a manner intended by the course team.

The difference in student attitudes to roles within the group was a natural consequence of the students' different backgrounds. There was another difference in roles between the courses, for in the Business course the tutors had a formal role, whereas in the Computing course they did not.

The role of the tutor

As noted in Chapter 4, the course teams had defined different roles for their course tutors. However, both sets of tutors retained their general role as an escalation point for issues. However, the onus remained with the student to contact them should there be a problem:

> *"…my experience from the past always is if they've got a problem, because they're mature, they're blinking well tell you" [CT1 interview]*

Notwithstanding the role assigned to the Business tutors, there were some comments from Business students that the tutors should have been more active:

> *"It would have been helpful … for the tutor to participate… and I would have found it easier and more productive to have a little bit of moderation…" [BS11 interview]*

The same student then counters with the argument originally used by the course Team to justify the limited role of the tutor:

> *"Now at one level I think, 'Oh for God's sake I'm in my 40s, grow up, why do you need a moderator?'" [BS11 interview]*

One of the expectations of the course Team is that the post-graduate students on this course, all of whom are employed or have been employed, should bring some pre-existing group work skills to the course. The Computing course Team had reached the same conclusion when deciding to eliminate the role of the tutor in their course.

In the Computing course, several students mentioned the absence of the tutor. For some this was a potential advantage:

"I think the advantages of not having the tutor involved [and having to look over your shoulder], and you might think that it would make the group flow a little easier perhaps." [CS2 interview]

For others, the tutors' absence was a disadvantage:

"…if they looked at the wiki and could see that somebody hadn't been participating just an e-mail to them to say 'Do you know that this is going on' it might just be all that was needed." [CS9 interview]

However, all Computing tutors did monitor their groups' wikis to ensure everyone was participating, even though this was not within their contract and they were not paid for it:

"Tutors must encourage students to participate from the beginning" [CT3 interview]

This same tutor saw one group where the students did look at their wiki, but no one wrote anything. She grew so concerned she sent them an e-mail to encourage them to start. Therefore, in both the Computing and Business courses, the tutors did encourage their students. Though not always with success:

"They [the students] were quite polite some of them, they replied, they acknowledged my reminders, 'Thank you very much for reminding me' and all that, but still they did not collaborate at the time" [CT4 interview]

During one interview, one student had an extended reflection on the possible role of the tutor, before coming to an interesting conclusion:

> *"[having a tutor in on the wiki] might have helped things along in some ways, but …in other ways I think it [their absence] reinforced a lot of the course concepts" [CS1 interview]*

This conclusion matched the course Team's intentions, that the students apply the course principles in an authentic process. Such a scenario meant that the students had to do the work; there could be no guiding mentor.

The Business course was similar in its approach to the role of the tutor, though for a different reason. The tutor was to be involved but only to ensure the students applied themselves to the work, not as a mentor with the content of the report itself. As one tutor acknowledged, she found working at this level:

> *"very frustrating... how [to] facilitate the process without getting in the way of the process (summative assessment)" [BT2 interview]*

Further, because the students were meant to be applying experience from their business sector, this meant that they were applying their work experience:

> *"I'm not sure why the tutor is required because we cannot add any topic knowledge" [BT2 interview]*

Therefore, the role of the tutors in both courses in practice was rather confused even though there were prescribed roles for them to fulfil. In such circumstances one might expect to find even more confusion in an area where guidance was deliberately omitted by both course teams: neither course defined the rules by which the students should work.

Establishing rules within the group

As described in chapter 4, the courses did not prescribe rules for the student groups. The course teams intended that the students would develop their own rules during the activities. This would allow them to gain practical experience of the group work processes as applied to requirements engineering or management research respectively. The need for rules, and the varied practical consequences of their absence, cropped up several times with the Computing students:

> *"The problem for us was more our internal playing rules." [CS1 interview]*

> *"It might have been an idea to establish some ground rules." [CS2 interview]*

> *"It wasn't issues with the wiki it was issues with the people using the wiki." [CS9 interview]*

> *"You can't force them to take part, leading to some interesting interpretations of deadlines for the collaborative activities." [Computing survey response 5]*

> *"It can be difficult to complete the collaboration and to decide when the collaboration is over." [CS58 TMA answer]*

There was a marked difference between the two courses regarding the development of the rules. In the Computing courses rules remained partly developed. In the first Computing course, such were the time pressures the students did not apply the lessons learnt during the collaborative work for assignment 2 in their work for assignment 3. Owing to the time pressures, the collaborative element of assignment 3 was dropped in the second presentation of the Computing course. There was no opportunity for the Computing students to apply their experience from assignment 2. In contrast, the Business students repeated their collaborative activity twice during the course. Thus, they had greater opportunity to develop, refine and apply rules as noted previously by BS12 with regard to roles.

A further example of this was seen in the earlier comments on the development of roles within the student groups. Three Business students adopted a Project Manager role for the second iteration of the collaborative activity having learnt the problems caused by the lack of clear leadership during the first activity, and the Project Managers were expected to impose rules on their groups.

Having considered the comments of students and tutors from the courses on the effect of the wiki on group work, and suggested causes for the behaviours reported, the final summary section of this chapter draws together the sixteen concepts set out above. From this an initial assessment of the ability of a wiki to support group work is derived.

5.3 Overview of Computing student attitudes

This section presents the results of the quantitative analysis of the Computing course online tools survey related to understanding the role of the wiki to support collaborative group work.

Survey question	Definitely Agree	Mostly Agree	Neither Agree nor Disagree	Mostly Disagree	Definitely Disagree
1) I found the wiki to be an effective tool for supporting my input to the collaborative activity.	10%	60%	15%	15%	
2) I found the wiki to be an effective tool for enabling my group members to respond to my input in the collaborative activity.		42%	11%	47%	
7) I found the wiki a useful tool to share the tasks in the collaborative activity.		50%	20%	20%	10%
8) I found the wiki a useful tool to schedule the tasks in the collaborative activity.		15%	15%	55%	15%
13) I found the wiki helped me plan and share the work with the group members.		20%	30%	45%	5%
14) I found the wiki helped me share my ideas with the group members.	5%	50%	25%	20%	
17) I found the wiki helped me improve my understanding of the benefits of collaboration in the Requirements Engineering process.	5%	75%	15%	5%	

Table 5-1: Student responses to closed questions on wiki use (N=20)

Twenty students completed the survey, selected in accordance with the OU's ethical guidelines as described in Chapter 3. Table 5-1 shows the student responses to the closed questions. The answers to question 1 suggest that the wiki was considered an effective tool to record a student's input to the activity. The application of a pseudo-Likert scale running from 1 for 'Definitely Agree' to 5 for 'Definitely Disagree' gives a favourable mean average score of 2.35 and a standard deviation of 0.85 for the answers to this question. Opinion, however, was divided on the effectiveness of the wiki to support responses to that input (question 2), resulting in a marginally unfavourable mean average of 3.05, with a slightly greater range of replies as suggested by the standard deviation of 0.94. Question 14 develops this exploration of the use of the wiki for refining ideas and content and asks how suitable was the wiki for enabling the students to share their ideas. In reply, the students give an unfavourable mean score of 2.6 with a standard deviation of 0.86 to the wiki. This suggests that the wiki was good for capturing ideas, but not for developing them.

This view of the wiki is repeated in the answers to questions 7, 8 and 13, which explore the use of the wiki as a management tool to co-ordinate the collaborative activity. Allocation of work within the collaborative activity manages a just favourable score of 2.9 with a standard deviation of 1.04. However, the scheduling and planning of the tasks, which require negotiation, have unfavourable average scores of 3.7 and 3.35 with standard deviations of 0.9 and 0.85 respectively.

The final question (17) was intended to explore whether or not the students thought that the collaborative activity in the course was an authentic activity. The course team intended the wiki to be a vehicle for the development of this understanding in their students, because it is a tool used in industry for this purpose. That the wiki did help the students gain this understanding is suggested by the favourable score of 2.2 and the narrowest standard deviation recorded in this section of 0.6.

In summary, the responses suggest that the wiki was considered a useful tool when used for capturing ‘data’, whether the data was the content for the activity or ideas that emerged during the activity. However, the students’ give less favourable responses about a wiki’s ability to support discussion of that data. This finding matched the concepts that emerged in the qualitative data analysis of the qualitative data presented in the first substantive section of this chapter.

5.4 Summary of emergent concepts

Table 5-2 shows a summary of the sixteen concepts that emerged during the qualitative data analysis relating the wiki as a tool to support collaborative group work.

Table 5-2: Summary of group working concepts

Concept	**Comments**
The wiki as a tool	The wiki was considered effective to capture initial content but the students had mixed views on the ability of the wiki to enable group work thereafter.
The use of the wiki	There was a marked division between the two courses: Computing – the wiki was used broadly as intended. Business – the wiki was not used as intended to facilitate group work. The Business students were highly critical of the wiki, though their judgement was coloured by the problems of using it for collaborative authoring which are discussed in the next chapter.
Knowing when the wiki content had been updated	This was a major concern highlighted in both courses which undermined the wikis use to support group work. This issue led to the use of other tools to complement the wiki, especially e-mail.
The widespread use of e-mail	E-mail was used by students on both courses mainly to keep up to date with changes in the wiki. While some groups adopted it for discussion there was no recognisable pattern as to which group would use e-mail in preference to the wiki for this purpose.
The place for discussion	There was little favourable comment on the wiki's ability to support discussion, and much hostility. (Factors leading to this attitude are considered in the two following concepts.) In the Business course, the forum provided a suitable supplementary tool that was well regarded by the students. In the Computing course various approaches were tried to address this issue, but none met universal approval.

Concept	Comments
Visibility of change	Seeing where a change had recently been made to the wiki content was a source of major confusion; and the wiki was universally found wanting in its ability to support this aspect of group work. The lack of visibility undermined the wiki's facility as a communication tool. Interestingly, potential solutions to this issue were not confined to technological enhancements, but some students suggested that organisational changes – the appointment of a chair to manage discussions, for example – could help too.
Distinguishing contributions within a wiki	This was a major concern of the students undermining their confidence in the wiki as a tool to support their work. There were two aspects to this concern. Firstly, it made it difficult for students to follow the flow of a discussion. Secondly, they were not confident that their contributions would be accurately identified for assignments.
The lack of inherent structure within a wiki	This potential advantage of a wiki caused problems in both courses; and there was not the time in the course for suitable structures to emerge. The initial overall structure and templates provided some guidance to the students, but there was a general feeling that the wiki should be set up in more detail to make it more usable from the start of the activity.
Student motivation	There was a marked division between the Computing and the Business courses that emerged as a consequence of the different intentions for including the collaborative learning activity in the courses. The Computing course was more successful at ensuring the students knew the activity was authentic and so was relevant to their studies.
Student socialising and forming a coherent group	The wiki had a very limited role in consolidating group formation, and was little used as a medium for socialisation. The two courses both included an ice-breaker activity in which students introduced themselves to their group. The activity was completed by all students as shown by VLE statistics, but the interview comments suggest it did not lead to any socialisation. The Business course's ice-breaker may be judged more successful than the Computing equivalent because it required the editing of others' contributions. Consequently the barriers to editing others work was not such an issue in the Business course as inferred from the students' comments.

Concept	Comments
Maintaining a group	The wiki did not encourage maintenance of a group. Social chat did not take place in the wiki. Instead, such socialisation as did occur within groups took place in e-mails mainly. This is in accord with the general finding that the wiki is good for capturing content, but relatively poor, compared to other tools, at supporting discussion.
Strategic learning	That students adopt a strategic approach to their learning is an inherent possibility in courses delivered as part of professional development; the students are focused on their professional development not the course. There is little evidence to suggest that the wiki influenced students' attitudes towards strategic learning one way or the other.
Additional time constraints	This is primarily an issue with introducing collaborative activities into a course. The students have to meet the deadlines associated with the activity as well as those related to the assignments. However, the wiki had a detrimental effect on the students, because of the locking mechanism. This mechanism imposed an additional constraint on the students' access to the collaborative activity. The constraint exacerbated the issue of making submissions by a given deadline. While the cause of the issue is the technical one of the locking mechanism, the impact could have been mitigated by co-ordination within each student group.
Roles within the student groups	Organisation of the group can play a key role in determining the effectiveness of the group. In this, there was a clear division between the Computing and Business courses. The Business students were generally better organised. Moreover, they had the opportunity to apply the lessons learned from the first activity in the second. The Computing students generally did not realise the benefits to be gained from assigning roles, and were not self-organising. There was a general realisation in both courses that the wiki would be easier to use if there were defined roles, especially for administrative tasks.
The role of the tutor	While notionally different, in practice both courses had the tutor in the role of 'policeman' to remind students of their need to contribute. However, the students did seem to appreciate it when the tutors took a more directing role, such as during the Business course ice-breaker activity.

Concept	Comments
Establishing rules within the group	As with roles, the Business students were generally more organised and realised quicker that the wiki could be more effective if the rules for its use were made clear. Although the course teams intended that the students should define their own rules within the course, the limited time in the course seemed to prohibit this.

5.5 Conclusions

This chapter addresses the first tier of the analysis and the ability of a wiki to support collaborative work in a distance-education course.

The one concept that was consistent across the students of both courses is the agreement that a wiki can support group working primarily because of its ability to support recording content. This is supported in Section 5.4 where the online tools survey found that the students considered the wiki an effective tool as a repository to enter data and to share their ideas; but was less useful for the tasks of developing and refining that wiki content.

One issue that became apparent, affecting several of the emergent concepts, is that the wiki had technical deficiencies. Possible solutions to the technical deficiencies are covered in Chapter 8, where the concepts and their implications are discussed.

In one area, discussion, the Business students were more content that the Computing students. The Business course used a dedicated discussion tool to supplement the wiki. In consequence, the Business students did not raise the same concerns about discussion that the Computing students did. The numerous approaches adopted in the Computing course to discussing the requirements they were developing suggests that the wiki was not appropriate to that task. The need to support discussion is arguably a crucial factor in the use of a wiki to facilitate group working, because group work, by its nature, requires discussion.

The placement of discussion was heavily influenced by two other concepts. The first is the practical issue of knowing when the wiki has been updated; students did not want to have to check the wiki daily to find out. To address this issue there was the widespread use of e-mail to notify group members of updates, because students did check their e-mail daily. Once the use of e-mail to supplement the group wiki was established, it was adopted by several groups for discussion too because it was a medium they were already familiar with for discussion. Since the Business students had already used a dedicated discussion tool, the wiki was undermined in its role of supporting discussion, and consequently was less able to support the refinement and development of its content.

This undermining of the use of the wiki to record discussion was reinforced by the difficulty of distinguishing an individual student's contributions. The students were concerned about how best they could enter and identify their work and as this could not be clearly and automatically done in the wiki, many saw this as a weakness. This relates to other concepts that suggest unhappiness with the wiki on the part of the students: the lack of inherent structure, lack of pre-defined rules, and lack of pre-defined roles. These all result from the wiki's flexibility; the wiki philosophy is that such concerns are not imposed as part of the wiki, but emerge from use of the wiki to best meet users' needs. In the absence of imposed constraints, inconsistency in wiki use emerged. Within the time available in the course, the students could neither create their own wiki structure, which undermined their confidence in the wiki, nor effectively define roles and rules, which undermined their confidence in the collaborative activity.

The wiki was not reported to enable group formation. The VLE statistics revealed that the ice-breaker mini-biographies went unread once the ice-breaker activity was completed. However, the wiki's ability to support asynchronous work, even across time zones, did prove useful to several groups. One may conclude that at a pragmatic, if not social, level a wiki has a role to play in supporting groups.

Throughout the courses there was some social chat, and much of what there was took place through the supplied forums (FirstClass for the Computing students, VLE forum for the Business). That this should not transfer to the wikis is not surprising as the forums were the established tools with which the students were familiar from other courses. Therefore, this study cannot conclude anything about the ability of a wiki to sustain social chat, other than it could not supplant an existing dedicated tool. However, other discussion, including that most directly related to the collaborative work such as planning and progressing the collaborative document, generally took place outside the wiki too. Other online tools, especially e-mail, were preferred. The factor that led student to prefer the use of e-mail for communication has already been noted: the message was delivered to the student without them having to check the wiki.

Therefore, one may conclude that the wiki can support group work because it enabled students to record their ideas, but the students preferred other tools to develop and refine those ideas. The different tools available to the students suggest this to be the case, with the Business students making good use of the provided VLE forum. The Computing students explored various means of tracking their developing ideas in the wiki, as will be related in more detail in the next chapter, and they explored various alternatives to the wiki for this task.

This suggests a potential weakness in wikis when used to support group work. A wiki can be effective at supporting co-operation, when the individuals work on their own tasks that are then merged to create a whole; however, it may be less effective in supporting collaboration, in which individuals work together on shared tasks. This, however, is dependent on the exact nature of the collaborative activity. However, the finding matches that reported in the first substantive section, that the students consider a wiki more effective in supporting capturing and recording ideas rather than refining and developing them.

The principal activities examined in this research required students to collaboratively author a document. The contrast in attitudes between the Computing and the Business students noted in this chapter, and the consequent manner in which they organised their groups, leads to a larger divergence in practices when looking at the ability of a wiki to support the students when they have to collaboratively author their documents.

The second research tier analysing the role of a wiki to support collaborative authoring is the subject of the next chapter.

Chapter 6 Collaborative authoring using a wiki

6.1 Introduction

This chapter examines how the students worked in their groups and used the wiki to collaboratively author a document. This addresses the second tier of the analysis to assess the challenges in collaborative authoring when using a wiki.

Collaborative authoring is the core task required of the students to complete their courses' collaborative activities. The students in both the Computing and Business courses had to collaboratively write a document as part of their summative assignments. This chapter identifies the factors perceived by students as helping or hindering the process when using a wiki as an authoring tool.

This Introduction section includes an overview of wiki use in the two courses. Thereafter the chapter sections follow the same pattern as those of the chapter 5. There are three substantive sections.

The first, section 6.2, presents the results of the inductive qualitative analysis of student TMA and examination answers, forum posts and wiki entries; and the follow up data from semi-structured interviews with students and tutors and the online survey and answers to reflective questions in their assignments in the Computing course. The emergent concepts were refined in *post hoc* semi-structured interviews with students and staff from the second presentation of the Computing course and of the Business course, and in the open questions in the student attitudinal survey conducted after the second presentation of the Computing course. Eight concepts emerged from the qualitative data analysis. There is overlap with those concepts already identified in Chapter 5, especially regarding the wiki's flexibility when the wiki is used to support distance education. The impact of the wiki's other key feature, simplicity, is also explored, and how it lead to a successful, though not wholly intended, use of the wikis by the students as a Content Management System (CMS).

The second substantive section presents the quantitative results from the Computing course online tools survey to provide an alternative data source to asses the emergent concepts.

The third section presents a summary of the final emergent concepts.

The next two sub-sections in this Introduction present a brief overview of wiki use determined by review of the wikis produced in both the Computing and Business courses.

Wiki use in the Computing course

Review of the wikis produced by the Computing students shows that all groups used the wiki to collaboratively author their requirements. There are some individual instances of students writing content outside the wiki and copying it in. As noted in Chapter 5, subsection *The use of the wiki*, writing outside the wiki was at the suggestion of the Computing course team to enable students to continue working even though the wiki page they wished to edit was locked. In contrast, many of the Business students took a different approach to wiki use. The Business students wrote their whole report, rather than just individual contributions to it, outside the wiki.

Wiki use in the Business course

The Business course students showed great resistance to using the wiki for report writing. In the first iteration of their collaborative activity, of the six reports:

- two were developed wholly in the wiki. The draft and final forms of the reports were both accessible from the wiki front page. The reports had a conventional online layout with a table of contents providing links to each section of the report that were written on separate pages within the wiki.

- two were written in Word outside the wiki and then copied and re-formatted into the layout described for the reports above.

- one was written outside wiki. The separate contributions were not brought together into a consistent style. When copied in to the wiki the report was not re-formatted. Instead, the report was presented as one long wiki page.

- one was written as a Word document and submitted to the tutor for assessment via the forum rather than the wiki.

In the second iteration of the collaborative report writing activity, of the six reports:

- two were written in Word and copied in as one long page without re-formatting.

- one was written in Word, copied in to the wiki and then re-formatted. The report remained as one long page within the wiki, but the table of contents linked to the report section within that page.

- two were written in Word, copied into the wiki and re-formatted to an effective multi-page online layout.

- one had a draft created in the wiki, and the final version written in Word and submitted to the tutor for assessment via the forum rather than the wiki.

This observed use of the wiki by the Business students represents a different approach to the writing task. The Business students mainly used Word for the actual writing task. As will be reported in section 6.2, Word was more familiar to the Business students, and it better met their expectations of a tool required to write a formal report than a wiki did. In contrast, the Computing students were favourably disposed to the wiki for authoring their requirements document and consequently used the wiki itself to write their requirements document.

6.2 Student and tutor comments on the use of a wiki to support collaborative authoring

This section documents the qualitative analysis of the responses by students and tutors to the semi-structured interview questions, shown in Appendix 3.5, asking about the wiki when used to support collaborative authoring. The data was supplemented with Computing students' assignment and examination answers reflecting on their experiences using the wiki as described in Section 3.3. The analysis was based on the principles of Grounded Theory to permit consistent concerns to emerge from the data without the presence of any presuppositions. The concerns were then grouped, aided by Activity Theory, to produce concepts. The analysis process is described in Section 3.2.

Eight concepts emerged from the qualitative analysis:

1. The wiki's limited feature set
2. Comparing the wiki with Word
3. Wiki as a central repository
4. The use of diagrams

5. Structure of the groups' wikis
6. Style within the documents
7. Roles for authoring
8. Rules for authoring

Each concept is now discussed in detail.

The wiki's limited feature set

When the wiki was first devised, Ward Cunningham, its creator, intended it to have a limited feature set so as to be simple to use and require minimal learning to use (Leuf and Cunningham, 2001). As with any software however, even if it is a simple wiki should still be sufficient to meet the needs of its users.

The replies in the two Computing end of course surveys suggest that Computing students did find the simple wiki sufficient for their needs. In the first survey, the standard OU survey conducted after the first presentation of the Computing course, none of the students criticised the authoring features of the wiki, though there was criticism of some technical aspects of the wiki. In the second survey, the online tools survey conducted after the second presentation of the Computing course, similar results are reported. In the survey responses, no student mentioned use of another writing tool in their group work and none directly criticised the authoring ability of the wiki. However, there were criticisms of the wiki as a tool:

"Slow and hard to format." [Computing survey response 14][9]

"The problem of formatting in the wiki made matters worse." [Computing survey response 11]

Two students found the editor too simple; they expected there to be more functions with richer formatting options such as the layout options and image embedding features found in other editors:

"I was expecting something a little bit more like Wikipedia just because it's what I'm used to with the richness in there." [CS9 interview]

"[being] a wikipedia editor, this wiki interface offends me!" [CS10 interview]

"basic wiki functions [but] it was not nearly as sophisticated as others I have used." [CS16 interview]

Though not all students encountered these issues, either with the feature set or with the wiki itself:

"I didn't meet any particular problems…" [CS7 interview]

In summary, the Computing students' complaints were directed against this particular implementation of the wiki rather than the concept of the wiki, and just under half of the students interviewed mentioned encountering problems. Indeed, during interview,

[9] Quotations are identified by the following codes: CS, Computing Student; CT, Computing Tutor; BS, Business Student; and BT, Business Tutor, with a statement of the source.

several students cited the benefits of a simple and flexible wiki as originally conceived by Cunningham (Leuf and Cunningham, 2001), which this student articulated as a strength of the course wiki:

> *"The actual content… [could] be put into place quite quickly and quite simply without any diversions or without the tool itself becoming anything that you had to learn or a hindrance" [CS8 interview]*

This concept of a relatively simple tool was repeated by one of the tutors:

> *"We're looking for something simple rather than something sophisticated." [CT7 interview]*

Another student highlighted the benefit of the wiki's simplicity:

> *"I don't think it could be much more straightforward really." [CS2 interview]*

This student explained that they appreciated not having to devote course time to learning to use the wiki. This suggests the wiki was sufficient for the needs for the Computing course's collaborative activity as intended by the course team. This view is supported by the students' replies in interview when asked about missing features, a typical answer was:

> *"I couldn't identify any particular improvements." [CS5 interview]*

When asked in interview if the wiki lacked any features, CS8 was one of the few to suggest a WYSIWYG editor be provided. He then added that while the wiki was not very good it was good enough for its intended use in the course. To which he commented, as an aside, that not having extra features meant there was less to learn:

> *"which was good." [CS8 interview]*

This finding, that the Computing students found the wiki satisfactory for their needs, is supported by the students' practice during the course. Only one Computing student abandoned the editor provided. Frustrated by the time spent on formatting text using the editor:

> *"I ended up editing using the html source. [CS16 interview]*

This was the only recorded use of direct HTML editing in place of the default mark up language.

The Computing students, whatever their previous experience with wikis, were able to use the provided wiki to collaboratively author the required document for their assignment. This was in marked contrast to the experience of the Business students, who relied on Word to write their documents as related in the next section.

Comparing the wiki with Word

The use of Word was encouraged by one of the Business tutors. When she responded to her students' concerns at some of the technical problems the wiki, such as locking, she advised her students:

> *"It's absolutely OK to prepare your individual contributions off line and paste into the wicki [sic]." [BT1 interview]*

As a result, half the Business students were then using a familiar tool to circumvent problems with the unfamiliar wiki. This was not a part of the original design of the Business course's collaborative activity.

The Business course team wanted students to bring their own experiences to the course, and share them through the collaborative activities. (The students were drawn from a wide range of commercial, governmental and voluntary organisations). As described in Chapter 4, the students were required to write a report on a current management issue. Crucially, the definition of a ‘report’ was not made explicit; it was to be what the students thought it should be based on their experience. This experience was summarised by one of their tutors in a general forum posting in response to a students concern at formatting text within the wiki:

> *“We're all so used to working in Word, which is custom-built to make document formatting easy” [BT2 interview]*

Word represented the common technology for the business students, despite their diverse backgrounds. Exploring the influence of this common technology during one tutor interview, she explained that the preference for Word was the students’ response to:

> *“The pressure of having to deliver in a new environment… whose particularities were not intuitive. I am not surprised they need [sic] time to think about it and they didn't have any and in consequence it turned into a barrier because what they found was the technology was not something you walked straight through.” [BT2 interview]*

Therefore, despite theice-breaker session included in this course, once confronted with a familiar task – writing a report – the subtle differences in behaviour between the wiki and Word were sufficient for the students to prefer Word because, in the words of a tutor:

> *“[The students] are used to sitting at their computers creating Word documents, sending them to people attached to a message saying have a look at this what do you think having somebody tinker with the document or send back feedback whatever.” [BT2 interview]*

This sentiment is expressed also by the students, for example:

> *"I'm not sure what advantage the wiki provided compared to what would have been secured through each of us posting a revised Word version of the report reflecting the additions/revisions we made." [BS14 interview]*

But then it is fair to argue that BS14 did not fully appreciate the features of a wiki, as shown in the later comment that:

> *"You couldn't even number pages!" [BS14 interview]*

This suggests a clear mismatch between expectations and the tool provided. The result, as one student said about the wiki, was that:

> *"It was used just as a necessity." [BS3 interview]*

Expanding on this she added that technical problems with the wiki (especially locking of pages) and familiarity with Word meant her group:

> *"…relied on old fashioned Word and forums" [BS3 interview]*

The wiki was used by her group only to submit the final version of the report as set out in the course guide.

One group of Business students was willing to persist with the wiki as an authoring tool because they wished to use the opportunity to learn about using a wiki. Ultimately they had to use Word because of the attitude of one of their number as seen in this forum posting:

> *"I'm going to continue using Word and uploading to the Wiki as this gives facility to do tracked changes and keep document control tighter (for me anyhow!)" [BS21 forum post]*

The student argued her case:

> *"I'm conscious that wiki doesn't allow the facility to "keep" previous versions and if changes aren't agreed by all team members it'll possibly be quite difficult for us to revert back to older versions?" [BS21 forum post]*

This statement is in error because the wiki does keep previous versions and the page can be reverted to an older version. However, none of her peers took up this argument. Examining the forum discussion indicated that the group was not confident with this aspect of wiki technology. The group adopted Word in response to this one group member.

The ability to track changes in Word is the one feature mentioned by both tutors and all but one student as critical in their preference for Word over the wiki. Only one Business student argued the opposite case:

> *"Better even than Track Changes in Word." [BS10 interview]*

The student justified this statement because track changes:

> *"It's very painful. You end up with loads and loads of things on the side. It's difficult to see really what's happened." [BS10 interview]*

This led the student to conclude that:

> *"The central precept of the fact we were writing a single essay together it [the wiki] was excellent… because that would be the only way we could have written that single essay, because there's no other way that we could have gone through the editing process that I could see that was effective." [BS10 interview]*

This one student preferred the clarity of the simple wiki content compared to the annotated Word content. His peers, as shown by their practice in the course, did not agree. However, they and the two tutors did make a favourable comment on one aspect of the wiki, as summarised by this otherwise critical student:

> *"It provided a central shared version of the report which any of us could work on at any time." [BS14 interview]*

Wiki as a central repository

In their final examination, 16% of the 196 Computing students mentioned the benefit of a wiki as a central repository, so that all relevant information was in the one place. This came over far more strongly in the interviews, and quite simply:

> *"It kept everything in one place." [CS6 interview]*

The benefit of this was expanded upon by another student who said:

> *"The wiki was efficient in that it was a central place for us all to put our ideas." [CS17 interview]*

This meant that:

> *"Document control [was] maintained/managed." [BS5 interview]*

In the end of course examination, one Computing student wrote:

> *"The most important function, for my opinion, is the possibility to trace all entries, changes and deleted entries." [CS10 examination answer]*

Overall though, only 8% of the students stated a wiki was good for version/source control, which indicates it did not make as strong an impression on them. However, their tutors, and the Business course tutors were much more enthusiastic. All made some comment similar to this:

> *"At least with the wiki you knew ... what you were looking at was the latest position." [BT1 interview]*

Even if it meant that the wiki:

> *"turned into a filing cabinet really." [BT2 interview]*

This use of the wiki was true for many of the Business course groups because they used Word for writing their report, and used the wiki as a Content Management System. Thus, the students appreciated the wiki as an effective tool for co-ordinating the written contributions, if not as an effective for making the written contributions.

The use of diagrams

Many Business students wanted to use diagrams in their reports. For example, BS8 used a diagram to illustrate the case study he proposed should form the basis for his group's research. He sent out the document containing the diagram, eliciting this response from one of his peers on the forum,

> *"And a great diagram (wish I knew how to do diagrams of that calibre on the pc!)." [BS8 forum post]*

However, the version of the wiki use at that time did not support images, as some students learnt the hard way:

> *"…have just posted my part in (with diagrams) - these have not transferred in to report. This is a bit disappointing as I spent some time drawing them!" [BS9 forum post]*

This led to some ingenuity as students sought to host images (diagrams and illustrated figures) outside the wiki. One student set up a Facebook group to host diagrams; but this caused some problems as only one other group member was familiar with Facebook. The others had something new to learn:

> *"I've got the invitation and I'm going through the technical barriers (what exactly do I have to do). Will get there eventually" [BS20 forum post]*

as shown by the parenthesised request for guidance from Business student 20.

Fortunately for the students, their tutor was able to use Facebook. So it was a valid tool for them to support their collaboration:

> *"it may well be the case that importing the document onto the wiki from word means we don't have some of the diagrams in which case we'll have to reference where to find them on the Facebook page." [BS22 forum post]*

The tutor was not solely committed to Facebook, and informed another group to:

> *"Let me know, too, where you are going to locate the diagrams (if you are planning to include any) for reading with the WIKI version." [BT2 forum post]*

It is worth noting that problems with integrating diagrams into the report were not confined to sharing them through the wiki. BS17 endeavoured to post them to the forum, but fell foul of the size limit for attachments. BS14 informed her group that,

> *"[The] Quinn diagram still needs putting in as I couldn't get it into my Word document for some reason..." [BS14 forum post]*

The group made increasingly urgent forum postings as the submission deadline neared and the diagrams themselves needed reworking: revising diagrams and justifying the revisions were more difficult tasks than the group had realised. The diagrams were not supported by the comments and version control possible within the wiki. Incorporating diagrams into the report added much complexity to the students' collaboration.

The Computing course makes extensive use of diagrams, as one student noted when asked if the course met her expectations:

> *"…if anything they are exceeding them. I didn't realise that the course materials would be as far reaching to include DFDs, UML, use cases, and other diagram work." [CS1 interview]*

However, the collaborative activity in the Computing course did not call for diagrams and so the absence of image support within the wiki did not become an issue with the Computing students. Only one Computing student mentioned the lack of image support in the final examination answers as a limitation of wikis, which suggests the issue did not make a great impact on the students.

This view is reinforced by the interview responses from the Computing tutors. Only one favoured the use of diagrams, and when asked later in the interview how the wiki could be changed to support the collaborative activities better, he replied that it should

> *"Have the capacity to add diagrams." [CT7 interview]*

In contrast, both of the Business tutors wanted diagram support added to the wiki. More explicitly, this student stated that the wiki would be improved by:

> *"Being able to slot into the wiki diagrams in line with the flow of text." [BS4 interview]*

Such views coloured the Business course tutors and students' perceptions of the wiki and of the collaborative activity: the tool could not support the report they wanted to produce.

Structure of the groups' wikis

The course teams did not impose a wiki structure on their students. The intention was for the wiki to support whatever structure emerged from the students' authoring, thereby exploiting the wiki's flexibility.

> *"Within the wiki it's interesting because it offers no structure. I did notice that it quite quickly got itself into being a sort of reasonably stable way that it came together" [CS8 interview]*

This assumes that there is time within the activity for a structure to emerge. In their end of course examination, 27% of the Computing students referred to the lack of structure in the wikis they had used and all considered it a problem. The Computing course team had defined a wiki with an outline structure that a placed a discussion alongside a content page. They also provided a template on how to present an individual requirement. But the course team had not provided any detail as to how the content pages that contained the requirements should be structured leaving that to be part of the learning process for the students. Though there is always the student who wants more:

> *"A good "wiki" would have for requirements a form like the Volere shell and added to each one a history and a discussion board." [CR16 interview]*

This leaves open the question how much prescriptive guidance the students should be given. In the case above, the Volere shell is one of the requirement engineering techniques taught in the course, and the student had recognised that it is the appropriate tool to use in answering this question.

The Business students too felt that guidance would have been beneficial, with all making a comment similar to the following about a sample report:

> *"The provision of a sample collaborative report on an issue not among the five chosen for the course might have been useful." [BS2 interview]*

In the absence of a sample report, the usual approach adopted by the Business students to developing the documents was (as noted earlier in 'Wiki use in the Business course' on page 160) to use one long page:

> *"One collaborative report has been placed on the WIKI and it has been loaded as one long page. As a result it takes ages to upload from the server. Can I ask you to put each section of your completed reports onto separate WIKI pages with links between them to the preceding and following pages? That will make it much easier for all of us to work with." [BT2 forum post]*

The tutor's guidance had come too late:

> *"Because the tutor only suggested that at the end of the second report, we thought, 'no' it's too much [to do]." [BS12 interview]*

This was despite the Business students' ice-breaker in which each student had their own page. However, at no point in this ice-breaker, nor in the Computing course's equivalent, were the students required to amend the structure of the wiki. They only amended some of its content.

"I had imagined at the beginning, that we were shown how to use different pages, and therefore how to structure a document, and to structure the information. In the event, despite the fact that I'd proposed a structure I found that my fellow students weren't receptive to that, and all the information was recorded in a linear fashion, so it was in one page" [BS11 interview

She continued:

"I was a bit disappointed that fellow students didn't want to explore how you could structure it in different pages. Too technical I think, which I find pretty disappointing" [BS11 interview]

This approach also exacerbated the locking problem that had encouraged the Business students to use Word instead of the wiki and made the page more difficult to read, as noted by this Computing student on his group's wiki:

I continued with scrolling up and down the requirements which, in hind sight, was probably not as efficient." [CS3 interview]

These problems can be avoided through an appropriate structure to the wiki. That the students were not aware of this, suggests a weakness in the explanation of the wiki given to them. This weakness was exacerbated by the time constraints within the courses that meant the students did not have time to explore the wiki's features for themselves.

Style within the documents

Neither course provided a style guide for their students. In its absence, findings in the literature review suggest that the primacy effect would dictate the wiki's style, as confirmed by one student:

> *"Whatever the first person does everybody else just adopts that house style for good or bad." [CS2 interview]*

With the expected outcome for the writing, that as the style was the product of someone's first document and not subject to later revision:

> *"The finished result was perhaps a little bit less polished than it might have been." [BS11 interview]*

The nature of the wiki encouraged this result:

> *"The informal and easy-to-access style of the wiki made us a little careless in our writing I suppose. The result was very raw text, partly chat-type. Further input would be necessary in order to turn it into a real requirements document." [CS10 interview]*

Nor did the course designs help address the lack of 'polish':

> *"They didn't have time to finish it [the requirements document] properly. You had this long trail of things not quite finished." [CT3 interview]*

However, all groups in both courses did manage to write documents that were sufficient for the assignment. The students were not assessed on the style of their work, only the content. The informal nature of the wiki and the time constraints within a course hinder the students' ability to produce a 'polished' document. In the context of these courses, in which allowance had been made for this issue, the unrefined writing style did not matter.

Roles for authoring

The collaborative activities in both courses did not prescribe distinct roles for individuals within the authoring task. Indeed, the Computing course was so designed that all students in a group had to write contributions and mutually review and refine the contributions. None of the Computing students, nor any of their tutors, identified the need for discrete roles to be assigned to individual group members when interviewed. However, in the Computing survey one student did allude to a dedicated role:

> *"In joint authoring, it would be good if there was a person whose task was to guide the discussion, format the inputs, check the document from time to time for open issues and decide when the requirements document is complete and when to stop iterations" [Computing survey response 1]*

The role envisaged by this student is much larger than that of just an editor because the role includes managing the group's collaborative work. This larger role is in line with the findings reported in Chapter 5, in which several students and tutors suggested that someone should have a management role similar in scope to that proposed above. However, none of those suggestions included the editing task specified by the Computing student above.

In practice, several students did take on an editing role to format the document as suggested by the student. In the second presentation of the Computing course, three students volunteered to reformat their group's wiki contents.

The same behaviour was observed in the Business course. The activity did not prescribe roles and when dividing the work to write the report, all groups allocated sections to an individual to write and then all mutually reviewed and refined the sections. There were two Business students who noted the need for an editor during interview:

> *"For each report we had the editor to finalise it but, as written, editing within the wiki did not work well." [BS3 interview]*

> *"There has to be a clear volunteer from the outset… undertaking the editing process." [BS2 interview]*

In practice, five out of the 12 wikis produced in the Business course were reformatted by a volunteer editor. Following up this use of an editor in the post-presentation interviews, the Business students stated that an editor was required because it was difficult to use to ensure consistent formatting in the wiki. The Business students wanted their reports to have a consistent look.

This view of achieving consistency in the wiki was echoed by one Computing student in the survey:

> *"[The wiki] is too reliant on the abilities of the people contributing to it. A better approach would be interviewing/prototyping, with just one skilled author writing the document." [Computing survey response 6]*

Therefore, we may conclude that the design of the collaborative activities meant that specific roles did not have to be allocated to individual group members to write the document. However, this did happen in practice as a solution to formatting problems when using the wiki.

Rules for authoring

Neither course provided formal rules for the students to engage in the collaborative authoring work. In contrast to the number of rules that the students devised to support their group work as discussed in Chapter 5, few rules emerged to support collaborative authoring.

No rules emerged to address the issues identified in previous sub-sections, such as enforcing a consistent style. These issues were addressed by the *ad hoc* measures described, such as an individual volunteering to reformat the existing content to a common style.

Two rules did emerge to support the co-ordination of the collaborative authoring work.

While several groups in the Business course produced lists to confirm who was writing which section of the report, one group went further. They prepared an Excel spreadsheet to track who was writing which paragraph and to record how far each had progressed.

The other rule also addressed the problem of co-ordination by requiring:

> *"everyone to post a message once they think they have finished their particular bits for the report" [BS11 forum post]*

This absence of rules, or discussion thereof in the forums, suggests that the students did not feel the need for more guidance with the details of writing their documents.

Having considered the comments of the students and their tutors from the courses on the effect of the wiki on collaborative authoring, the final section of this chapter draws out some conclusions from the findings.

6.3 Overview of Computing student attitudes

This section presents the results of the quantitative analysis of the Computing course online tools survey related to understanding the role of the wiki to support collaborative authoring. The survey design was informed by the results of an initial inductive qualitative analysis of online data gathered from the first presentation of the Computing course. The survey was conducted with students from the second presentation of the Computing course.

The results of the relevant questions in the online tools survey are presented in Table 6.1.

Table 6-1: Student responses to closed questions on using the wiki for writing their documents. (N=20)

Survey question	Definitely Agree	Mostly Agree	Neither Agree nor Disagree	Mostly Disagree	Definitely Disagree
9) I found the wiki a useful tool for writing the requirements developed in the collaborative activity.	5%	50%	20%	15%	10%
11) I found the wiki a useful tool to help me modify the requirements in the collaborative activity.	10%	40%	20%	25%	5%
18) I found the wiki helped me take part in the task of writing the requirements.	15%	50%	15%	10%	5%

Twenty students completed the survey. There were two direct questions in the survey relating to the wiki use for collaborative authoring. Question 9 elicited the students' perceptions on using the wiki to capture requirements; and question 11, their perceptions on using the wiki to refine the captured requirements. The application of a pseudo-Likert scale running from 1 for 'Definitely Agree' to 5 for 'Definitely Disagree' gives a favourable mean average score of 2.75 for both questions. However, this hides the greater range of responses from the answers to question 11 compared to question 9 as can be seen in the table, though by a statistical quirk both questions have a standard deviation of 1.09. More students were favourably inclined to using the wiki for writing the requirements than for modifying them. This was offset by the greater enthusiasm of some students for using the wiki to modify the requirements, hence the same statistical results. The diversity of opinion among the Computing students was examined in more detail in section 6.2.

The results from survey questions 9 and 11 provide additional information to the survey results presented in Chapter 5. In Chapter 5, looking at the use of the wiki to support collaborative work, the students considered the wiki useful for capturing 'data', whatever form that data took, be it activity content or emerging ideas. The answers given to question 9, in which the wiki is generally viewed favourably for writing the requirements, supports the result in Chapter 5. However, in Chapter 5 the students disliked the wiki when used to support discussion; and discussion is necessary to refine the requirements. This suggests there may be a distinction in wiki use: the wiki is useful in recording the refinements, even if it less useful in enabling the discussion that leads to the refinements. The distinction in wiki use is explored in section 6.2 While all students could appreciate the use of a wiki to record data, their expectations as to what was needed to refine the data – and record their discussions of the refinement – could not be met with the simple wiki available within the course even though the wiki was sufficient for the task as envisaged by the course team.

The third survey question in Table 6-1 was included to confirm the responses to the earlier questions. It has the more favourable mean average score of 2.37, standard deviation 1.04, suggesting that overall the Computing students were favourably disposed to using the wiki for collaborative authoring. All groups in both presentations of the Computing course successfully used the wiki to author a set of requirements suitable for their marked assignments.

6.4 Summary of emergent concepts

The emergent concepts addressing the second tier of the analysis to identify the challenges in collaborative authoring when using a wiki are shown in Table 6-2.

Table 6-2: Summary of collaborative authoring concepts

Concept	**Comments**
The wiki's limited feature set	There was a marked contrast between the two courses: • • the Computing students were pragmatic and generally accepted the wiki as a sufficient tool for their requirements, • • the Business students did not take to wiki as an authoring tool in part because of the limited feature set. Two features in particular affected the Business students use of the wiki: • • the text editor lacked the rich features of a dedicated word processor such as Word, (see 'Comparing the wiki with Word'), • • the absence of an image editor, or at least simple support for embedding existing images, (see 'The use of diagrams'). The contrast suggests that the issue lies not with the wiki as a tool, but with the activity design, since the same wiki was used in both courses' activities.

<table>
<tr><th>Concept</th><th>Comments</th></tr>
<tr><td>Comparing the wiki with Word</td><td>The Business students compared the text editor abilities of the wiki unfavourably with the rich feature set of Word, a dedicated word processor. They:
had the expectation that to write a report they should use a tool such as Word, despite the advice in the course guide,
wished to use Word because it was a familiar tool,
recognised the problem of version control with Word however, and so still made use of the wiki, though less so as an authoring tool. (See ‘Wiki as a central repository’.)
In contrast, the Computing students were satisfied with the text editing abilities of the wiki. They understood the nature of the document they were to produce and were more confident in using the simple wiki editor. Therefore, they were not drawn to compare the wiki with Word.

As the wiki and Word are tools designed to serve different purposes it is not appropriate that they should be compared. That the students did this, suggests that the wrong expectations had been set.</td></tr>
<tr><td>Wiki as a central repository</td><td>The wiki was used as a central repository by the students of both courses to store their developing writing. Students from both courses reported the use of the wiki as a central repository as a benefit, and one that directly helped in the authoring process because the students always knew where the most up-to-date version of the document resided.

This benefit was achieved differently between the two courses:
generally the Computing students entered content directly into the wiki,
whereas the Business students preferred to use Word for writing and refining content and then to use the wiki as a Content Management System. (See ‘Comparing the wiki with Word’.)</td></tr>
</table>

Concept	Comments
The use of diagrams	The collaborative activities did not call for diagrams as the version of the wiki then in use did not directly support images. However, the Business students had the expectation that a report should include diagrams, and attempted to incorporate them into their reports. This was not without problems, not all of which relate to the wiki but rather to the students themselves. Use of a diagrams implies additional software that the students must access and know how to use. The lack of familiarity with Facebook shown by one student in this study highlighted the problems that can occur when faced with unfamiliar software within the time constraints of a course. To design a wiki-enabled collaborative activity that requires additional software negates one of the key advantages of a wiki; it runs solely within the user's web browser. In addition, because of the limited functionality of a wiki, it should be intuitive to use, so minimising the learning demands placed on the students. (This consideration does not apply should one of the learning outcomes for the course being to learn to use the additional software.) Therefore, designers of wiki enabled collaborative activities need to consider the scope of their activity carefully, and adjust the time available to the activity within the course if additional software must be installed and learnt.
Structure of the groups' wikis	The absence of a structure is meant to be a benefit of a wiki, in that the users can structure the information to meet their specific needs. Within the time constraints of the course, and the lack of experience of the students with both the wiki and the course material, effective structures did not emerge in either of the courses. Provision of a suitable template structure would enable the students to be more productive, as they could focus on the content itself and not on structuring the content. The ice-breaker activity could be extended to add and delete within the wiki so that the students can amend the sample structure efficiently. An appropriate structure would minimise the locking, loading time and readability problems inherent with long pages.

Concept	**Comments**
Style within the documents	No document style was explicitly defined in either course. The course activities were so designed that unpolished final documents were acceptable. Both course teams considered the content of the wiki more important than its presentation. The Computing course made this emphasis on content clear in the course documentation. The Business students too were told that the emphasis of their work was to document the management issue they were studying; however, this was forgotten because of their expectation that they had to write a report for their senior management. This was not an issue with the wiki as with the activity design and setting the appropriate expectations of the students.
Roles for authoring	No roles were defined by the course teams for their students. The only role to emerge from the courses was that of an editor. This was partly in response to certain issues with the wiki editor, especially with formatting text. The technical issues observed are not present in the enhanced editor now in use by the OU, and in many other wiki editors. However, whatever wiki is used, an editor for consistent style may be beneficial in presenting a polished report should that be required. (See ‘Style within the documents’.)
Rules for authoring	No rules were defined by the course team for the students, and few emerged in response to issues during the collaborative activities. Those that did emerge related solely to co-coordinating contributions and can be seen as an extension of the management rules to support group work. This suggests that guidelines for those rules may be sufficient to cover collaborative authoring too.

6.5 Conclusions

The original concept of a wiki was for a simple tool, providing a feature set requiring a minimum amount of learning before effective use can be made of it. Ease of learning is achieved at the cost of the range of activities the wiki can support.

The wiki's functionality provided adequate authoring facilities for the limited scope of the documents required in the two courses' collaborative activities. In both courses, all groups produced the required documents for individual students to submit as part of their summative assignments.

No student reported problems with understanding the basic features of the wiki. However, the students' ambitions for the layout of their reports, particularly the Business students', exceeded the capabilities of the wiki provided. This suggests that students may need more guidance on the nature of the documents a wiki can readily support perhaps by supplementing the existing course guidelines and their focus on the technicalities of wiki use with more explicit templates for the final document.

The use of wiki as a Content Management System (CMS) also requires careful consideration by the activity designers. The wiki can be successful in this use, but students need to be aware of good working practices because they will be writing the content in another tool, and then must ensure the updated content is stored in the wiki for sharing with their peers.

Chapter summary

This chapter has addressed the second tier of the overall analysis and addresses the challenges in collaborative authoring when using a wiki. The chapter has shown that a wiki can support collaborative authoring.

A wiki can support collaborative authoring by allowing students to either enter content into the wiki directly or use the wiki as a Content Management System. The wiki's success in either of these two roles is determined by the design of the collaborative activity. In the current research, the wiki was quite simple with limited functionality in line with the original concept of a wiki (Leuf and Cunningham, 2001). This success was achieved in two ways. In the Computing course the collaborative activity was designed within the limitations of the wiki's feature set, while in the Business course allowance was made for the students to work beyond the limitations of the supplied wiki. However, all students in the research were able to collaboratively author using the simple wiki to produce a document suitable for submission as part of their assignments.

In addition to the wiki's simplicity, the wiki implementation in this study adopted the other key feature of wiki philosophy: flexibility. The wiki's flexible nature with the absence of a pre-defined structure or a pre-defined method of working was not appreciated by the students. Guidance and interventions from the course teams and tutors helped address the subsequent students' concerns.

The research identified eight emergent concepts, which are summarised in Table 6-2. The consequences of these concepts, and how they inter-relate to the other two research tiers, are further discussed in Chapter 8.

Having considered the ability of a wiki to support the writing of a document as part of a collaborative activity, the next chapter addresses the third and final tier, whether students can use a wiki to facilitate collaborative learning arising from their collaborative activities.

Chapter 7 Collaborative learning using a wiki

7.1 Introduction

The previous two chapters examined two specific collaborative tasks. Chapter 5 addressed how students used the wiki to support their work as a group, and Chapter 6 addressed how students used the wiki as a collaborative authoring tool. In contrast this chapter examines the collaborative activity as a whole to review the ability of a wiki to support a collaborative learning activity. This chapter addresses the third and top most tier of the analysis to address if wiki activities can facilitate collaborative learning as intended.

The collaborative activity is included in the course so that the students have the opportunity to learn through collaboration. This opportunity should mean that the students can learn things collaboratively that they might not learn if working individually. The student collaboration should, ideally, match the course team's intentions, based on the assumption that the intended collaboration is the one that will achieve the stated learning outcomes for the course.

The sections for this chapter follow the same pattern as the previous two chapters. There are three substantive sections. Section 7.2 presents the results of the inductive qualitative analysis relating to the use of the wiki to engender learning. The section draws data from both the Computing and the Business courses. Section 7.3 presents the quantitative results from the Computing course online tools survey. The chapter finishes with a discussion of the challenges that arise when adopting a wiki for collaborative learning activities.

7.2 Student and tutor comments on the use of a wiki to support collaborative learning

This section documents the qualitative data analysis of comments on the wiki when used to support the collaborative learning activity. The analysis was based on Grounded Theory to permit the emergence of codes through iterative review of the data as it was collected over the three presentations. The codes were then grouped, guided by Activity Theory, to form coherent concepts. Eight concepts emerged from the qualitative analysis:

1. Sight of other students' contributions
2. Dialogue about other students' contributions
3. Authentic learning to engage the students
4. Learning as intended
5. Support for formal reflection
6. Other learning opportunities
7. Concerns with privacy of contributions
8. Concerns with security of contributions

Each of the eight concepts is now discussed in detail.

Sight of other student's contributions

Many students when first asked about the main benefit to their studies from the wiki answered in general terms:

"Facilitating collaboration with other students." [Computing survey response 3] [10]

"Getting to interact with fellow students." [Computing survey response 5]

"The chance to interact with my course-mates" [Computing survey response 13]

On following up these general answers in the interviews, all students clarified that the main tangible benefit was the ability to see the other students' contributions. This was described as a benefit because it offered:

"A chance to see someone else's perspective and opinion on the topics and ideas that I had in mind." [Computing survey response 2]

This in turn enabled:

"Seeing other people's interpretation of the course material and requirement construction." [Computing survey response 12]

The ability to see other students' views on a topic provided alternative expressions of the meaning for that topic. The multiple expressions of the same topic helped the students clarify their own understanding.

"The collaborative activity allowed me to see how the others addressed this question and evolve my own contribution and understanding based on these." [CS29 examination answer]

[10] Quotations are identified by the following codes: CS, Computing Student; CT, Computing Tutor; BS, Business Student; and BT, Business Tutor, with a statement of the source.

Thus, the emphasis was on the wiki supporting a student's individual learning by providing contrasting material for personal reflection rather than by providing direct interaction with their peers. However, this was sufficient to enable an iteration of the students' ideas, with revised topics being submitted to the wiki. As one student put it:

> *"It's also about the act of trying things out… What you do is you learn to actually employ that, which in turn feeds back as 'OK, that wasn't quite the way to express the requirement, it wasn't quite the way to express all…" [CS8 interview]*

Thus, reflection need not be confined to passive observation of the other contributions. This benefit was made easier by the wiki's use as the central repository for all material developed in the collaborative activities:

> *"I think the fact that everything was there and readable helps… quite easy to see the process in one place… there was no feeling of sort of having to collate information from lots of different places." [CS8 interview]*

This meant there was little additional effort required by the student to see the other contributions, so removing a barrier to the reflective task.

Another benefit of seeing the other contributions was articulated by this student as:

> *"One can identify ambiguity in other people's requirements far easier than one can in one's own." [CS30 TMA answer]*

In the Computing course, the process of reviewing others' contributions was used to help improve the requirements developed during the collaborative activity:

> *" by looking at what other people's contributions were [I was] beginning to understand what made a good requirement and how to refine it, and [to] actually*

see the process because it's really difficult on your own to do that. It's very difficult to do that." [CS8 interview]

Expanding on the ability of a wiki to make a process visible, about a third of students reported that the benefit to their learning was not solely from seeing their peers' work, but also in seeing how their peers worked:

"The benefit was less from dialogues so much as just the visibility. You could see other people working and how they were working." [BS10 interview]

When asked for more detail, the student gave as an example:

"…the way in which people search websites, and the way in which people search the libraries as well, as opposed to let's just use the articles." [BS10 interview]

This student had made use of the opportunity in the collaborative activity to learn more than just core course concepts. The theme of sharing approaches as well as ideas is expanded upon by this student:

"As an individual, one can get bogged down with the detail of requirements elicitation and specification and fall into bad habits. Working collaboratively allows us to share experiences." [CS30 TMA answer]

In a similar vein, this student learnt something about his peers' and his own attitudes when asked if he found the wiki useful:

"Yeah, I did find it useful. Looking at the ways other people approached things I found quite surprising. I used to assume that everybody would approach things from the same angle as me. Of course they don't." [CS2 interview]

However, as related in Chapter 2 the sharing of experiences among students can lead to learning that is more effective if it is supported by dialogue.

Dialogue about other students' contributions

Dialogue is needed for effective collaboration, but as noted in Chapter 5 the students did not favour the wiki for discussion. Rather, the students considered the wiki:

> *"Cumbersome for conversations." [Computing survey response 2]*

However, on the Computing course comments were posted within the wiki to refine the requirements. These posts did prove to help the students:

> *"The feedback and comments I received allowed me to do a stocktake of the requirements I entered for TMA02." [CS105 examination answer]*

This student made the benefit explicit:

> *"Having to state a requirement and have it reviewed by others makes you release [sic] what assumptions you had made internally on looking at a problem." [CS6 examination answer]*

Understanding that feedback improved the quality of their requirements, there were some examples of students encouraging feedback:

> *"I definitely enjoyed reading your requirements and your comments to my own ones" [CT1 group 1 wiki]*

And there were several examples of the developing discussions being captured in the wikis. These included extended clarifications:

"Doh! Jon youâ€™re right. Re my stuff below â€“ it was late and I obviously wasnâ€™t paying enough attention. Checking back to the TMA, it seems that this requirement should fail the quality gateway, even if it had been correctly identified as a functional requirement, because from the information we are given in the TMA â€˜â€¦ Finally, the website will permit any registered user â€¦. To view statistics on missed appointments. (Patients who request this information will also be told if they have missed any appointments in the preceding year.)â€™. This implies that the patient is not to be given the choice of specifying a date range for missed appointments." [CT2 group 1 wiki][11]

"<22/7 XX> Oops. Yes, I did mean MB3. Interesting that you should mention a report, though. When I first read MB3 I assumed (presumably because it is worded as "the customer" rather than a plural "members") that it was referring to some indication on the screen when someone tries to make a booking. Alan's interview in the TMA does, however, read more as if some sort of report is required." [CT5 group 1 wiki][12]

And the dialogue can be considered to be of high quality because statements were supported:

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[11] Note the control characters in this wiki extract. This shows that the original text was prepared outside the wiki and copied in, which was a useful clue when reviewing the use of the wiki for authoring and when the wiki was supplemented by other writing tools.

[12] The MB3 referred to in the quotation is the group's reference for the requirement they are discussing.

“<MH - I wanted to say that we need to record some data about the usage of the facilities - not the bookings (which are made before by telephone or in person).>
<PC - I see what you mean now,maybe re-word to something like 'The product shall record when a customer has completed their appointment', although I can't think of a better word for completed (as in visited the fitness center to undergo the session they booked?).
<DF - How about "attended" instead of "completed"?>
<PC - yes, that's the word I was looking for!>
<WF - As I understand it the product shall keep track of whether an appointment was actually kept. I feel, this requirement is properly addressed by the re-wording>” [CT1 group 1 wiki]

“In reference to Xxxxx’ comments above I have disagreed with some of his analysis for the following reasons:” [CT6 group 1 wiki]

The contributions were not confined to the requirements needed for the assignment. The students also discussed course concepts alongside the requirements:

“The discussions from this activity helped me to reflect on my own views and potentially modify them (and the requirements) to incorporate the good ideas that arose from the group.” [CS29 examination answer]

Or, as this student stated in the survey:

“[That the wiki helped with] exchanging thoughts and lining up the concepts.” [Computing survey response 15]

And as this student made explicit:

"The feedback from other students highlighted misunderstandings in course material." [CS15 examination answer]

With this example taken from a wiki:

"… I have gone back to look at MRP and can see what you are saying and I think I agree with you." [CT6 group 1 wiki] [13]

This level of discussion is not found in the Business course wikis because the course used the VLE forum for discussion. In the Business course's first collaborative activity the wiki was accessed 7,240 times, and the forum 8,386 times. In the second, the wiki was accessed 4,842 times and the forum 8,169. As noted in Chapter 6, the Business students did more of their writing outside of the wiki in the second activity, an assertion supported by the wiki access statistics. However, we can infer the amount of discussion did not change between the two iterations of the group activity within the course because the number of forum accesses remained similar for both[14].

Authentic learning to engage the students

The Computing students recognised the course collaborative activities as an authentic representation of the RE process:

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[13] The MRP referenced in the quotation refers to *Mastering the Requirements Process* by Suzanne Robertson and James Robertson, published by Addison-Wesley, 1999, and which is the course set book.

[14] No students dropped out during this presentation. The same number of students completed both iterations of the activity, divided into the same number of groups. The activity itself was the same for each iteration, only the subject under review changed.

> *"It was a useful simulation of dealing with collaborative requirements engineering" [Computing survey response 4]*

This student appreciated the learning opportunity afforded by the authentic activity:

> *"I really liked the wiki activity as it really drove the requirement gathering stage process procedures home." [Computing survey response 15]*

This encouraged their engagement with the activities as an opportunity to learn:

> *"If its [sic] something if you have to do it in real life you're going have to go through that process and get it right. Its not simply an academic exercise, so I like that about it and I think that's where you really learn, you really begin to understand the material itself." [CS8 interview]*

This was especially so for the practical aspects of the RE process:

> *"Clearly being required to collaborate with others forced me to come to terms with the 'co-operative' aspect of RE." [CS2 examination answer]*

However, only two of the interviewed Computing students reported using wikis at work. A third said she was about to use a wiki, having just changed jobs. A sentiment echoed by another student in their survey response:

> *"As it happens, at work I really needed to know what wikis are about, so it was a very helpful experience to try them out in practice!" [Computing survey response 1]*

That the students considered the wiki as an authentic tool, despite their limited personal experience, could be considered a successful learning outcome because this was one of the course team's intentions: the students should be aware of the increasing use of, and relevance of, wikis in RE.

None of the Business students reported using a wiki at work. This contributed to a sense of dissatisfaction with the activity as a whole. While the joint writing of a management report was recognised as an authentic activity, the choice of a wiki as the primary tool was not. As discussed in Chapter 6, this helped lead to the Business students' choice of Word as their preferred authoring tool.

Learning as intended

The wiki was provided in the Computing course to support an authentic activity. The course team hoped that through collaborating on this authentic activity the students' learning experience would be enhanced. That this happened is suggested by this student's description of what they learnt about the RE process and how to refine a requirement:

> *"The rationale I had written for some requirements was not the true rationale and this was only made clear to me when some members of my group made comments to that effect. It made me realise that to find the true rationale of the requirement one has to keep asking 'why?' until the real reason for the requirement is discovered." [CS56 examination answer]*

Thus, from the comments made by his peers, the student learnt both about his requirements and about how to generate requirements. This is the only explicit example of double-loop learning (Argyris and Schön, 1974) found in this study.

More typically students described any enhanced learning as being a product of mutual support groups:

> *They [the other students] helped me see my errors and provided some set book references I'd missed. It was like a mini study group that helped show the problems of requirements gathering in practice. [Computing survey response 17]*

This student described the learning process in more philosophical terms:

> *"The confirmation or the argument of someone else is a valuable part of reaching to the truth" [Computing survey response 2]*

Thus, for most students their learning was enhanced because of the mutual support and review available by working in groups. Two students, however, did give examples of learning through engagement with the collaborative activity to gain insights they would not have acquired without it.

This first student learnt through practical experience that requirements need not be objective, but could be subjective:

> *"I guess I learned how different perspectives, different interpretations can affect what requirements you get through to a certain extent." [CS4 interview]*

Hence, this student experienced that requirements need not be an objective review of the world but that they were subject to personal interpretation.

This second student learnt the role a wiki, and by extension any tool, played within his group in the RE process because it:

> *"Provided an example of how a single form of requirements gathering presents issues in terms of interpretation of comments." [Computing survey response 11]*

The student experienced the limitation in any requirements process that arises when only one technique is used.

The Business students were directed to form 'action learning sets' and so had the expectation that they would support each other through their sets. The nature of the activity design encouraged the mutual review process too.

In the Business course, the course team wanted the collaborative activity to enhance their students' learning by giving them the opportunity to learn from their peers' experience. The benefit of this was appreciated by their students, even if it was only to inspire the question:

> *"Why have you put that in I don't understand?" [BS12 interview]*

The Business students did learn through research and mutual support with sharing of personal experience as intended. Further, several recognised that they had been exposed to new issues as intended by the course team:

> *"I have learned about the topics which I probably wouldn't consider to research under different circumstances." [BS3 interview]*

Support for formal reflection

The use of the wikis for informal reflection has already been noted in this chapter. In the interviews the students were asked if they used the wikis for more formal reflection on their learning before taking the end of course examinations. The answers to this question can be summarised by this reply:

> *"Not at all!" [BS2 interview]*

Only one student interviewed, a Computing student, said he used the wiki after the completion of the collaborative activities for reflection and revision prior to the exam. However, almost half of the Computing students interviewed replied that they had considered using it:

> *"I thought we might come back to it for exam revision, but in the end I think most people were going over to the forum and things like that." [CS1 interview]*

The Computing students felt that the course materials provided all they required for the examinations.

The Business students were required to reflect upon the issue they had studied in the collaborative activity and relate it to their own workplace. This they did, but none felt the need to refer back to the wiki to support their reflection. The Business course wikis were used solely as described in Chapter 4, Course collaborative activities and course team intentions. The wikis were used to collate the students' collaborative writing during the course activities. All Business wikis were made publicly available on completion of the second activity to provide the Business students with an introduction to those management issues they had not researched as part of their own course work. Thus, the wikis were used as another information source to support student reflection when the students related the issue to their own workplace. However, the Business students were not called upon, and none voluntarily engaged in, reflection on their individual learning during the course.

Other learning opportunities

As noted in the earlier subsection, *Sight of other students' contributions*, almost a third of Computing students reported the benefit of looking at how their fellow students approached the collaborative work, from how they constructed the requirements to how they searched for information online. This matched the course team's intention that the collaborative activities would give the students the opportunity to learn more than just the course concepts.

The course team expected that most of the post-graduate students would already possess group work experience, and would make use of the experience in the collaborative activities. Thus, the students were not expected to learn about group work, but would have the opportunity to share their existing experience, and put it into practice in a new environment. This student appreciated the intention:

> *"This is valuable experience on how to work within a group and how to deal with different personalities that relates well to the workplace." [CS44 examination answer]*

The ability to learn about one's peers alluded to above, was also expressed by another student:

> *"I think I learnt more about requirements engineers than about requirements engineering process in many ways." [CS7 interview]*

However, during the interviews only one student explicitly made mention of acquiring a 'transferable skill'. The one mention was by a Business student who identified a skill area they had been able to develop in the course:

> *"The project management." [BS3 interview]*

This Business student's particular response regarding project management ties in with the findings in Chapter 5 when several students identified the need for someone to assume the role of project manager to facilitate the collaborative activity. Generally the role was assumed by someone who already possessed project management experience. Here we have one example of a student who was able to develop that experience as a bonus to the intended learning from the course.

The other role identified by students as beneficial to the collaborative activities under review was that of an editor. However, none of the students interviewed, nor any survey response or examination answer, mentioned that a student had developed 'editing' as a skill during their work with the wiki.

If the students did not report learning about the technical aspects of the wiki, there were several comments on a wiki's cultural aspects as with this student who drew the contrast between using a wiki at the OU:

> *"Especially in an OU course one can expect that everyone is open-minded and on schedule" [CS35 examination answer]*

And at work:

> *"Also note that in a 'real' wiki some people may not be willing to contribute because of fears that their comments will not be taken seriously or are put down. Hence a culture for a wiki must exist within an organisation." [CS35 examination answer]*

In the final examination, three Computing students mentioned that in the workplace one might be *"afraid to enter silly suggestions"* or a similar sentiment; whereas only one student thought it an advantage of a wiki that *"one can suggest silly ideas"* and another student expressed the same sentiment more diplomatically with reference to a *"blame free environment"*.

The lack of reference to the willingness to contribute and how the contributions might be regarded, shows that only a handful of students, literally five in this case, reflected sufficiently on this aspect of a wiki in the workplace to mention it in the examination. This in turn suggests that the cultural aspects of a wiki were not of major concern to the students, as either a positive or a negative feature of the wiki.

In their examination answers, 6% of the Computing students mentioned the public aspect of a wiki as positive feature because it permitted all contributions to be shared. However, 5% mentioned visibility as a problem, citing privacy concerns through all content– potentially – being seen by all users of the wiki. To address this, 3% suggested the need for a private/offline discussion space when a wiki was used at work.

For completeness, there is one occasion to report when a student appears to have failed to take the opportunity to learn from practical experience with the wiki. In the final examination one Computing student made the factually incorrect statements that a drawback of a wiki was that it “did not track changes” and that “no versioning existed”.

Concerns with privacy of contributions

The public nature of the wiki could facilitate academic misconduct, though this fear was expressed by only one student.

> *“The wiki activity allowed students to piggyback ideas from those who clearly studied the course in detail & these revised ideas could easily be passed off as one's own "idea" which was annoying!” [CS18 examination answer]*

This comment was made at the end of the first presentation of the Computing course. One other student from the first presentation made a similar comment regarding his concern for the attribution of his contribution to the collaborative activity. He used this concern to draw a distinction between the use of a wiki at work, when he considered visibility of its contents to be an advantage, and the use of a wiki in assessed learning, where the same visibility might present a problem:

> *“I was also reluctant to use the wiki at first because I did not like the idea of publishing my answers to TMA questions for review and criticism by fellow students. So I felt that there was a privacy issue which only arose because of the nature of the course.” [CS56 examination answer]*

The course teams were aware of the potential for plagiarism a wiki presents, and had designed the collaborative activities and their assessment accordingly. In addition, both courses emphasised that the wiki History page provided an auditable record of edits to the wiki. This audit trail was primarily intended for tutors to verify all student statements in assignments about contributions and refinements they had made to the wiki should they have any concerns about academic misconduct. The trail provided a secondary benefit of re-assuring the students that their contributions in the summative assessment could be accurately assigned to them because it was comprehensively:

> *"keeping a record of what's been done." [CS7 interview]*

Or, as this student expressed the same idea but from a personal perspective:

> *"I think that's what converges in the end you've got a record of a process for me." [CS8 interview]*

Indeed, even CS56, the student whose concern for privacy was noted earlier, was only "*reluctant at first*" to contribute to the wiki, before coming to appreciate the benefits of mutual review. That privacy was so little mentioned suggests that the course teams were successful in addressing this potential student concern.

Concerns with security of contributions

Similar to the concern discussed above was that of retaining a contribution in the wiki without it being overwritten by another student. This potential concern seems to have been addressed by highlighting the wiki's *diff* function to students. The facility shows the selected wiki page before and after it was edited with any changes highlighted, and was described to the students as a means to track changes in the wiki. Its intended primary use was to support tutors assess the veracity of their students' statements. However, the fact that such a function existed, and with it the ability to roll back any changes, seems to have discouraged the wholesale overwriting of contributions by any student.

The *diff* facility was occasionally used by the students. For example, in the second Computing course, of the 19,044 student accesses of the wiki, only 387, about 2%, were *diff*s. The facility was even less used in the Business course. Of the 9,076 student accesses during the two assignment collaborative activities only 18 were *diff*s. However, it was in the Business course that there occurred the one example of recovery of an old version of a page using the wiki's History facility:

> *"but one of the problems we were finding that somewhere along [the way] we managed to delete something and then we had to track through back all the edit[s], the changed things to find out where it had all disappeared" [BS3 interview]*

Of the 56 wikis studied, this was the only use of the wiki's History to recover lost contributions.

As an adjunct of being used to track changes, the History facility could also support reflection. However, in this study this proved not to be the case because:

> *"It's very difficult to see this particular requirement came from here, because you would look at the history of the whole thing rather than that particular requirement" [CS7 interview]*

The ability effectively to track changes in the wiki depends on the wiki structure. In the Computing course, typically all requirements were recorded on one page. Therefore it was difficult to track changes because the changes were recorded at page level rather than requirement level.

The primary intended use of the History facility was to support tutors; however, it was disliked by all tutors on both courses. In the Computing final examination, only three students mentioned that traceability through the facility was poor, as might be expected given how little used the *diff* function was by students.

The Business course avoided the issue of plagiarism by having each group submit a jointly authored report. This meant that the issue of assigning marks to individual contributions, and copying thereof, did not arise. The individual component of the students' assignment related to the application of the report's management issue to the students' own place of work

7.3 Overview of Computing student attitudes

This section presents an overview of the students' attitudes to the wiki when used to support their collaborative learning activity. Twenty students completed the Computing course online tools survey at the end of their course as described in Chapter 3, with a copy of the survey attached as Appendix 3.2. The results of the quantitative analysis of the closed survey questions related to the role of the wiki to support collaborative learning activities are shown Table 7-1.

The questions cover a variety of topics about the activity and student engagement with the activity. The questions are divided into four groups. Each group addresses a common topic. A discussion of each of the four topics follows.

Table 7-1: Student responses to closed questions on the use of a wiki to support collaborative learning activity. (N=20)

Survey question	Definitely Agree	Mostly Agree	Neither Agree nor Disagree	Mostly Disagree	Definitely Disagree
1) I found the wiki to be an effective tool for supporting my input to the collaborative activity.	10%	60%	15%	15%	
2) I found the wiki to be an effective tool for enabling my group members to respond to my input in the collaborative activity.		42%	11%	47%	
3) I understood why a collaborative activity was included in the course.	63%	37%			
4) I did not see the point of a collaborative activity in this course.		10%	5%	35%	50%
5) I thought the collaborative activity was an essential part of the course.	35%	35%	25%	5%	
6) I can see why a wiki was used to support the collaborative activity in the course.	25%	55%	5%	15%	
10) I found the wiki a useful tool to discuss the requirements developed in the collaborative activity with my group members.	5%	45%	15%	25%	10%
12) I found the wiki a useful tool to help me reflect on the collaborative activity.		35%	35%	25%	5%
14) I found the wiki helped me share my ideas with the group members.	5%	50%	25%	20%	
15) I found using the wiki helped me have a constructive dialogue with the group members.		35%	25%	35%	5%

Survey question	Definitely Agree	Mostly Agree	Neither Agree nor Disagree	Mostly Disagree	Definitely Disagree
16) I found the wiki helped me improve my understanding of the Requirements Engineering process.		50%	25%	15%	10%
17) I found the wiki helped me improve my understanding of the benefits of collaboration in the Requirements Engineering process.	5%	75%	15%	5%	
19) I have improved my understanding of the potential application of wikis in Requirements Engineering.	25%	60%	10%		5%

Student engagement with the wiki

Questions 1 and 2 relate directly to the students use of the wiki. The application of a pseudo-Likert scale running from 1 for 'Definitely Agree' to 5 for 'Definitely Disagree' gives a favourable mean average score of 2.35 with a standard deviation of 0.85 for question 1. This suggests that the students found the wiki a useful tool to record their input to the collaborative activity. In contrast, the students have given an unfavourable mean score of 3.05 with a marginally greater standard deviation of 0.94 in response to question 2. This suggests the students did not consider the wiki to be a useful tool for responding to that input. This indicates there may be a limit to the support a wiki can offer for collaborative learning opportunities, while the wiki can help students capture their ideas, it might be of less use in refining their ideas.

The limitation of a wiki to support discussion was explored in Chapter 5 because it affected how the groups used the wiki to support their collaboration. The Computing students turned to other online tools, especially e-mail, for the discussion and refinement of their ideas. The use of supplementary tools for student dialogue suggests that the wiki alone is not sufficient for a collaborative learning activity. This suggestion is important because there must be a dialogue among the students to lift the activity from mere co-operation, in which the students co-ordinate their individual activities towards a common goal, to collaboration, in which the students share in the activities. In their common experience through sharing in the activities, students may be able to learn more than they would individually. This suggested limitation of a wiki matches that reported in Section 7.2 looking at the qualitative comments.

Student engagement with the activity

The next four questions in Table 7-1 examine the students' engagement with the activity. As identified in Chapter 2, the literature review, student engagement can influence not only the quality of their learning but their style (strategic or deep) too. Student engagement is particularly important in distance education because of the inability to provide face-to-face support to students that could address the individual's lack of motivation.

Engagement is additionally important in the Computing course because the collaborative activity is an authentic activity. The course team intended that their students not only learn about Requirement Engineering (RE) concepts, but also learn about RE practises and tools that support RE practises. The course team were particularly keen to use a wiki in the course because Requirement Engineers in commerce and industry are using wikis to facilitate their group work. The addition of an authentic activity to the course provides students with the opportunity to experience RE practise and tools. The student responses suggest that the course team were successful in communicating this concept to their students.

Question 3, with a positive mean score of 1.37, standard deviation of 0.48, shows that the students understood why the collaborative activity was included in the course.

Question four, which effectively restates question three but in the negative, has a mean score of 4.25, though with a wider spread of responses indicated by the standard deviation of 0.94. The two mean scores agree well. The agreement suggests a correlation between the answers. Later interviews confirmed that the students understood the role of the collaborative activity in the course as intended by the course team. The students had gained the understanding from the course materials, especially the description of the collaborative nature of RE.

The students' correct understanding of the nature of the course, as suggested in the answers to questions 3 and 4, is emphasised in the students' response to question 5. This had a mean score of 1.85, standard deviation of 0.79, and indicates that the students mostly considered the collaborative activity itself an essential part of the course. This suggests they could relate to the activities' authentic nature.

Question 6 was similar to 5, but asked about the use of the wiki, to examine whether the students considered the tool as essential to the course as well as to the activity. The mean score for question 6 was 2.10, standard deviation of 0.94. This score is slightly less positive than for question 5, though the score still indicates strongly that the students saw the authentic nature of the wiki in the activity. However, there was a greater range answers given in question compared to question 5. This meant that the total number of students who expressed a positive view was greater in question 6 even though the overall score was less positive. In reply to question 6, 80% of students 'definitely agree' or 'mostly agree' that they understood why the wiki was used in the course, compared to 70% who gave one of those two answers to question 5. The role of the critical reading exercise in the first assignment was identified in the interviews as being the significant factor in explaining this result. As described in Chapter 4, the students had to read and critically review a paper on the use of wikis to support RE teams in industry.

Thus we may conclude that the course team had successfully designed a course and could justify its design (the collaborative activity) and tool use (wiki) to the students. Hence, the potential for a student to disengage from the activity because they do not have such an understanding seems to have been reduced. This in turn suggests the course team has set up the course so that not only are many students aware they have the opportunity to engage with their peers and learn deeply, but that they are more likely to do so because they appreciate the authentic nature of the opportunity.

Student engagement with learning

The four questions 10, 12, 14 and 15 were intended to elicit the students' views on the ability of the wiki to support their learning.

Question 10 asked about the use of the wiki to support discussion of statements written in the wiki, in this case the requirements the students had to collaboratively write for the assignment. The students were only slightly favourably inclined to using the wiki for this form of discussion, as shown by the mean score of 2.90, standard deviation of 1.14. The range is quite significant because 50% of the students gave a positive reply to 'definitely agree' or 'mostly agree' with this use of the wiki and 35% gave one of the negative replies of 'mostly disagree' and 'definitely disagree'. This answer, related to a tangible requirement, forms a baseline for comparison with questions 14 and 15 that explore the same issue but with regard to less tangible course concepts.

Question 14 asked whether the wiki was effective at enabling the students to share their ideas. A mean score of 2.60, standard deviation of 0.86, and comments from the students reported later in this chapter suggests that the students found the wiki useful to record their developing ideas of the course concepts. This is supported by 55% of students giving a positive response and only 20% a negative one; a slightly more favourable view of the use of the wiki for sharing concepts than that reported for sharing the requirements. This suggests the wiki can help the students to make their developing ideas available for discussion with their peers. However, question 15, which asked about any consequent dialogue, has a marginally negative mean score of 3.1, standard deviation of 0.94. This suggests the wiki was not useful for the students to refine their ideas. This is in line with the problems reported in Chapter 5 when the students used the wiki for general discussion. Thus it seems reasonable to suggest that the wiki does not help the students externalise their ideas and engage in what Vygotsky (1978) termed an inter-subjective dialogue.

Question 12 was intended to complete the analysis of Vygotskian learning and asked the students if they used the wiki for reflection to internalise the ideas. The wiki could help this process by providing a record of their ideas, and any discussion relating to the ideas. The neutral score of 3.0, standard deviation of 0.89, suggests the wiki neither helps nor hinders the Vygotskian intra-subjective dialogue of the student. The interviews reported later in this chapter indicate that the answer is slightly more complicated than that suggested by the survey.

Student impressions on their learning

The final three questions shown in Table 7-1 (survey questions 16, 17 and 19) explore the students' perceptions of the possible benefit of the wiki when the students were developing their understanding of RE as taught in the course.

Question 16, with a mean score of 2.85 and standard deviation of 1.01, suggests that the students understanding of the RE process was helped through using of the wiki.

The course highlights the collaborative nature of the RE process, and a favourable score of 2.2, standard deviation of 0.60, in question 17 suggests that the students found the practical experience of collaboration helped them understand this concept. The favourable mean score of 2.0, standard deviation of 0.89, to question 19 indicates that the students could extend their experience of using a wiki in the RE course to the wider use of wikis in RE in industry as intended by the course team.

The overall positive results for these three questions confirm the findings of the earlier questions that the students understood the collaborative activity to be an authentic activity and thereby supported the learning outcomes.

In summary, the responses indicate that the wiki was considered relevant by the Computing students to their course, and they were motivated to use it. There was some disengagement from the wiki caused by its inability to support dialogue as effectively as other tools. However, the wiki and the activity were thought to support teaching of RE in the course, which is what the course team intended.

These findings match those reported in the previous sections, where the reported qualitative comments provide more detail on where the Computing students felt the greatest benefit arose, and contrasts the experience of the Business students.

7.4 Summary of emergent concepts

Table 7-2 complements the introductory summary of concepts with the findings described in Section 7.3 above.

Table 7-2: Summary of collaborative learning concepts

Concept	**Comments**
Visibility of other students' contributions	The effect of being able to see other people's contributions to the wiki was to encourage personal reflection by students on their own contributions. This reflection included both the contribution itself and the process by which the contribution was made.
Dialogue about other students' contributions	The students did discuss their wiki contributions. This discussion covered both wiki entries required for assessment and broader course concepts. The students used their peers' feedback to inform their personal reflection as well as to further explore the topics under discussion. The students reported enhanced learning, through being guided to reference materials for example, arising from this feedback. Nearly all students reported the interaction with their peers as a positive aspect of the courses, and encouraged their engagement with the activities.
Authentic learning to engage the students	The students recognised the authentic nature of the activities, and were motivated to engage with the activities. However, while the Computing students recognised the authentic nature of the wiki, this was not true with the Business students. The Computing students used wiki in the manner intended by the course team, while the business students did not.
Learning as intended	The students did learn in the manner intended by the course teams. The Computing students did discuss their contributions to the wiki and, when the occasion, arose did discuss course concepts. The Business students did use the activities to discuss the management topic they were researching and to share their personal experiences about the topic under review.
Support for formal reflection	The Computing students did not use the wiki for formal reflection. The Business students were able to use the wiki reports to review a third topic for their final examination.
Other learning opportunities	There were few examples of the students using the opportunity to learn more than the matters directly linked to course concepts.
Concerns with privacy of contributions	The students' learning was not hindered by concerns of losing credit for their work when sharing it with their peers.
Concerns with security of contributions	The students' learning was not hindered by concerns of losing their work when sharing it with their peers.

7.5 Conclusions

This chapter was concerned with the ability of a wiki to support collaborative learning activities. The activities were included in the courses for pedagogical reasons to support the intended learning outcomes. The activities' primary purpose in the courses was to engage the students in an authentic exercise, relevant to their workplace and using an appropriate tool. This would result in:

- enhanced learning opportunities for the students as they applied the theoretical material they were taught in a realistic activity,
- the opportunity to develop and refine their own understanding of the course concepts by sharing their view of the concepts through the wiki with the other students.

For the intended benefits to be realised the students needed to engage with the wiki, the activity and the intended learning. The course teams recognised this and provided background material as described in Chapter 4 to explain the relevance of the collaborative activities and the use of a wiki to the students. This chapter shows that the course teams were broadly successful. There was, however, a problem in engaging the Business students with the wiki because for most of them it was a new tool, and one they were not likely to encounter in the workplace. However, notwithstanding this one issue, it would be fair to summarise that the course teams' first intention for the collaborative activities, to provide an authentic learning opportunity, was realised.

The students reported that the main benefit to them of the wiki was the ability to see the other students' contributions. This matches the course team's second intention for the wiki, that it should support the students to develop and refine their understanding of the course concepts. However, much of the dialogue about course concepts occurred outside of the wiki, because the students found other tools better suited to this purpose. Yet, the wiki still played a role in supporting the dialogue because it provided a common repository for the written documents being discussed.

In its role as a repository, the wiki had two further benefits for the students.

The first benefit was that it allowed the students to look at their peers' contributions. This supported the students' personal, informal reflection on what they had contributed to the activity. This benefit was intended by the course team.

There was a second, albeit unintended, benefit for the students in using the wiki as a repository. The course team had intended the wiki's audit trail to be used by course tutors to verify student contributions. Yet the students valued the audit trail too. The students felt it was easier to share their ideas because in case of dispute the wiki audit trail could show who had made which contribution. As such, the audit rail removed a barrier to the students' willingness to engage with the activities because the students did not fear plagiarism of their contributions.

If the core intentions for the course collaborative activities were well met, in contrast the other opportunities afforded to the students were not. While there was much discussion about course concepts, there was little learning of concepts outside those necessary for the course. Similarly, the presence of a body of written material for retrospective review did not result in the students engaging in formal reflection using it. This suggests other factors were at play affecting the students differing use of the opportunities presented to them. These factors and their interplay across the ability of the wiki to support group work, collaborative authoring as well as providing the opportunity for shared learning experiences are discussed in the next chapter.

Chapter summary

This chapter has addressed the third and final tier of the analysis and addresses the ability of a wiki to facilitate collaborative learning as intended.

There is evidence that the students experienced enhanced learning in the manner intended by the course teams by the inclusion of the wiki enabled collaborative activities. This was achieved despite the absence of any distinct teaching activities within the course on how to use or exploit a wiki. The students' own reported benefit to their learning was through the opportunity to see how their fellow students were also coming to terms with the course concepts. The wiki provided a secure medium to make this possible.

This chapter, and the previous two chapters, describe the emergent concepts from the data analysis, each chapter taking the perspective of one of the three research tiers. The next chapter provides a synthesis of the emergent concepts to draw generalisable conclusions.

Chapter 8 Synthesis and Discussion

8.1 Introduction

The investigation into the use of a wiki to support collaborative activities in distance education has revealed a number of guidelines or recommendations for the effective use of a wiki in distance education. This chapter presents guidelines for designers of wiki supported collaborative activities, which are the primary contribution of this research.

The first substantive section of the chapter presents a synthesis of the findings from which the guidelines are derived. The findings are those of the inductive qualitative analysis described in Chapters 5, 6 and 7. Each of those chapters addresses one of the three research tiers that were identified in the first iteration of the inductive qualitative analysis. Subsequent iterations, and confirmation through post-presentation interviews and surveys, allowed the codes for each phenomenon of interest to be refined. The resultant codes were grouped into concepts informed by Activity Oriented Design Method (AODM), following the process described in Chapter 3. Using AODM's Operational Mapping tool, described in Section 3.2, the inter-relationships among the 32 concepts that arose are presented in the sub-sections of Section 8.2.

Section 8.3 presents a summary table of the guidelines with explanatory comments.

8.2 Emergent concepts grouped using operational mapping

This section presents a synthesis of the concepts identified in the data analysis presented in Chapters 5, 6 and 7. Thirty-two concepts were identified:

- 16 concepts in Chapter 5, Table 5.2, addressing research tier 1,

  Is a wiki a good medium for collaborative work in a distance-education course?

- 8 concepts in Chapter 6, Table 6.2, addressing research tier 2,

  What are the challenges in collaborative authoring when using a wiki?

- 8 concepts in Chapter 7, Table 7.2, addressing research tier 3,

  Can wiki activities facilitate collaborative learning as intended by the course team?

The concepts are classified using the Operational Mapping tool, the fourth of Activity Oriented Design Method's tools. (The Activity Oriented Design Method and its tools were described in Chapter 3.) The tool is a means of breaking down an activity system into smaller sub-activity triangles to make analysis easier. The tool enables the mapping of processes and relationships between sub-activity system components that can help identify contradictions.

The emergent guidelines are noted in the synthesis description that follows in this section. The guidelines are presented together with a commentary in Table 8-7 in the next section.

Table 8-1 shows a count of the concepts that emerged from each research tier and relates them to a sub-activity triangle. The concepts mapped to five of the possible sub-activity triangles. The table is the product of the last stage of the analysis workflow 0reported in chapter 3.

Table 8-1: Table mapping concepts to sub-activity triangles

	RT 1	RT 2	RT 3	Totals
Subject—Tool—Object-ive	8	6	2	16
Subject—Rules—Object-ive	2		1	3
Subject—Community—Object-ive	2		3	5
Subject—Rules—Community	2	1	2	5
Subject—Community—Division of Labour	2	1		3
Totals	16	8	8	32

Each of the sub-activity triangles and their assigned concepts are discussed in the following sub-sections. In the discussion body, concepts are identified by italic text.

Subject—Tool—Objective

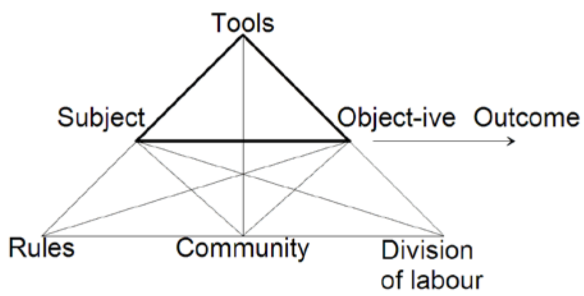

Figure 8-1: Sub-activity triangle Subject—Tools—Object-ive

The sub-activity triangle shown in Figure 8-1 focuses on how the students' use of the wiki affected the production of the assignment documents.

As might be expected in research focused on tool use, more concepts are assigned to the sub-activity triangle that has the tool at its apex than any other. In this research, half of the emergent concepts are assigned to the Subject-Tools-Object sub-activity triangle. The relevant concepts are listed in Table 8-2.

Table 8-2: Table listing Subject—Tools—Object-ive concepts

RT 1	RT 2	RT 3
The wiki as a tool	The wiki's limited feature set	Authentic learning to engage the students
The use of the wiki	Comparing the wiki with Word	Support for formal reflection
Knowing when the wiki content had been updated	Wiki as a central repository	
The widespread use of e-mail	The use of diagrams	
Visibility of change	Structure of the groups' wikis	
The lack of inherent structure within a wiki	Style within the documents	
Student motivation		
Strategic learning		

A strong theme reported in Chapters 5 and 6 was the students' perception that the wiki was beneficial when used to record ideas. All 56 groups were able to record their ideas and produce the documents required for assessment by their tutors. The documents provided a focus to the collaborative activities. Therefore, we can conclude that a *wiki as a tool* is suitable for the production of documents required in collaborative learning activities, which leads to an introductory guideline. The rest of this sub-section discusses this conclusion in depth.

Guideline: Use a simple wiki to produce documents as part of collaborative learning activities.

There was a marked difference in the use of the wiki across the two courses. For the Computing students the wiki was an authentic tool. This view was reinforced for them by the course materials that included reviews of wikis used in software engineering. The authenticity was further reinforced because several students used wikis at work and shared this experience with their peers. Most of the other Computing students were aware of wikis even though they did not use them at work. In contrast, this *student motivation* to use a wiki was lacking in Business students, primarily because none of them used a wiki at work. The result was a different willingness to engage with the wiki between the two courses. The Computing students persisted with the wiki as an authoring tool even when they encountered problems. In contrast, the Business students did not perceive the wiki as an authentic authoring tool, and so on encountering problems with the wiki, resorted to Word as their preferred authoring tool. Word was seen by the Business students as the relevant authentic authoring tool for the document they were asked to produce.

The two courses attempted to engage the students with texts introducing the wiki concept. In the Computing course the introduction to wikis took the form of an assignment question in which the students reviewed a paper on the use of wikis in Requirements Engineering. This helped reinforce the relevant nature of the collaborative activity. The Computing course team successfully communicated that this was *authentic learning to encourage the students*. The Computing students were duly encouraged to use the wiki as part of the learning opportunities the course offered because they could practice using a realistic requirements engineering tool as part of a realistic requirements engineering process in the course.

The Business students were introduced to wikis as an abstract concept not situated in the workplace. They were given Wikipedia as an example of a successful wiki. As described in Chapter 2, Wikipedia can be considered a relatively sophisticated wiki. The MediaWiki used in Wikipedia includes several features not available in the course wiki. The Business students, however, expected that the course wiki had the rich feature set of Wikipedia's MediaWiki. This led to several problems when they used the wiki as a collaborative authoring tool because it failed to live up to their expectations as recorded in forum posts and discussions with their tutors. The Business students were not supplied with an example of a wiki used in business, nor with an example of a wiki with the relatively limited feature set they would use in the course.

The difference in student expectations, and consequent engagement with the wiki, leads to the second guideline.

Guideline: Supply examples of relevant wiki use to encourage engagement with activity.

The differing expectations among the student cohorts led to a different *use of the wiki* between the two courses.

The Computing students used the wikis as intended by the course team, and as described in the course materials. The students were able to do this in part because the correct expectations had been set but also because the authoring task was within the capabilities of the wiki.

The Business students, however, expected to produce a ‘report’, which implied to them that the finished document should have a professional presentation.

The course teams in both courses had stated that unpolished documents were acceptable. While there should not have been an issue with the *style within the documents*, because it was the content that would be assessed not the presentation, interview answers showed that this assessment criteria was universally forgotten or ignored by the Business students. To them, a report meant something produced in Word, using the features available in Word. Therefore, even though the authoring task had been composed to be within the capabilities of the course wiki, the students looked for Word-style editing features in the wiki. In *comparing the wiki with Word,* the students did not like the *wiki’s limited feature set*. The misunderstanding can be seen in inappropriate complaints noted in a forum post such as the wiki not supporting page numbering. This leads to the third guideline.

Guideline: Set expectations about available wiki features.

The problem of the perceived level of features was compounded by the Business students' ambitions for their reports. In the retrospective interviews, three students suggested that a report template would have been beneficial, to set the correct expectations. A report template might also have addressed the technical problems the Business students encountered such as when one group tried to write their report as one long page, which was slow to load and to edit. The Business students' work did suffer from the *lack of inherent structure within a wiki* because they did not have the experience to exploit the flexibility a wiki offers.

The Computing students in the first presentation also viewed flexibility as a problem initially, as seen in discussion among students, tutors and the course team. The students were not clear what content they should provide. The course team quickly addressed the problem by providing a template for the students to record the requirements. The template has been used on all subsequent presentations of the Computing course.

While a template for the requirements was provided for the Computing students, there remained guidance only for the structure of the wiki. In their final examination question on the advantages and disadvantages of a wiki, 27% of Computing students commented that the lack of inherent structure was a weakness of wikis. The Computing students' wikis did show a variety of internal structures, with some having pages defined by iteration of the requirements, and others having pages defined for each requirement. The students outside experience influenced the degree of sophistication in a wiki's structure. In one case, as noted in chapter 5, one student when interviewed stated that he was dissatisfied with the editor and had coded his wiki contributions in raw HTML using this to code directly the hyperlinks he wanted among the wiki pages.

Review of the wikis showed that none were restructured during the course presentation, nor did any group experiment with alternative structures in their wikis. In interview, the absence of change and experimentation was stated as being due to the time pressure within the course. The students focused solely on producing the documents required for the assignments. The students of neither course took advantage of the opportunity to explore the possibilities of a wiki.

The need to make students focus quickly on producing the required documents within the time available in the course leads to the fourth guideline.

Guideline: Provide template and structure appropriate to the intended output.

A further example of the ambition of students to go beyond their course teams' intentions in the documents was the Business students' desire to include diagrams in their reports, despite their wikis not supporting images. It should be noted that *the use of diagrams* was not necessary in any of the documents to fulfil the assignments. The issue of image support raises the larger issue of what functionality should be included in a wiki. The OU VLE wiki in use at the time of data gathering did not include support for images. The current OU VLE wiki does support embedded images. There is no agreed editor or change control mechanism for the images, which causes the support and workflow problems that wikis were originally devised to address. In the context of this research, investigation of the application of the original wiki concept, image support was outside of the scope of the research; however, the question of image support is relevant because the absence of image support affected the Business students' view of the wiki as a tool. This was a major contributory factor according to forum posts and confirmed by both Business tutors explaining why the wiki did not meet the students' expectations and so discouraged their use of it for authoring.

Disappointed with the wiki's intrinsic authoring functionality, as well as the lack of support for images, the majority of Business student groups used their wikis as Content Management Systems (CMS). In its role *as a central repository*, no Business student reported any dissatisfaction and many praised the positive aspects of a CMS when interviewed. When asked about this use of the wiki as a CMS, several Business students commented on their use of a document repository at work. Hence, it would appear that we have the students applying their work experience to the course as desired by the course team though not with the intended result.

As expressed by the Business students in interview, the wiki addressed problems associated with circulating copies of Word documents by having a central, controlled version of a document accessible to the students. The wiki had a beneficial role in the collaborative activity even though it was not used for collaborative authoring. The published literature on using wikis in higher education seems to have only one example of the use of a wiki as a document repository CMS, Byron (2005). The research reported here suggests that it is a successful approach worth further consideration by course designers, and leads to the fifth guideline.

Guideline: Consider using the wiki as a document repository Content Management System.

As a consequence of the wiki providing a central repository, students could use the wiki as *support for formal reflection*. This was true of the Business students who read reports written by other groups in preparation for their final examination. However, no Computing student engaged in similar assessment driven reflection, though in the interviews two did indicate that they would have liked to formally review the wikis before their final examination had more time been available in the course. Almost a third of the Computing students in their TMA reflective question responses stated that the wiki enabled them to engage in informal reflection by reviewing the wiki content, and that the reflection aided their progress in the course. This supports Piccicano's (2002) and Chen *et al*'s (2005) findings. Thus we may infer that a wiki can encourage deep learning through reflection for many students. In the TMA reflective question responses no student stated that the wiki had the opposite effect, discouraging reflection and leading to a *strategic learning* style. This was confirmed in interview.

This leads to the sixth guideline, which aims to help students gain the most benefit from the opportunity to see their peers' contributions.

Guideline: Include personal reflection in the activity.

A criticism about the wiki's functionality from students on both courses was *knowing when the wiki content had been updated*. Students were familiar with looking at their e-mail daily, but not at checking the wiki daily. The usual measure adopted by students to address the problem of not knowing when the wiki had updates was *the widespread use of e-mail*. It became commonplace to send out a notification e-mail when making an update to the wiki. The use of e-mail was reinforced by the students' preference for discussion to take place outside the wiki, because e-mail was used to facilitate discussion too.

Another factor encouraging discussion to take place outside the wiki was the lack of *visibility of change* in the wiki. This meant that the students were not always aware of what had changed, or if prompted to review a change by an e-mail, the students were not always aware of where to find the change within the wiki even though they knew what the change was. The topic rose several times in wiki and discussion posts across all three presentations studied. Various solutions to this problem were proposed when the problem was mentioned in the end of course interviews: two students suggested technical enhancements to the wiki, which are discussed in Chapter 9; and three students suggested the appointment of a chair to formally manage discussions and changes to the wiki, though Countinho and Bottentuit (2007) have reported disappointing results with this approach. Though the students suggested appointing a chair, no group did. Whether this would in fact solve the problem is a matter for future work.

During the courses, students supplemented the wiki with dedicated discussion tools. The students' preference to use several tools each with particular capabilities matches the use of multiple tools proposed by Zeller (2007) in contrast to the all-in-one approach of Louridas (2006). The empirical evidence indicates a preference for dedicated tools. This leads to the seventh guideline.

Guideline: Use a dedicated discussion tool to supplement the wiki.

It should be noted that the rules governing the use of multiple tools took time to emerge, and for the Computing students the delay slowed progress with the writing task judging by the sequence of wiki posts discussing the issue preceding work on content. For the Business students the issue was another factor in some abandoning the wiki as an authoring tool. The subject is covered in the sub-section Subject-Rules-Object.

In summary, the students' use of the wiki did influence the production of their assignment documents. The students adopted two strategies: the first, and the one intended by the course team, saw the students write the documents in the wiki; the second saw the students use the wiki as a CMS and write the documents in the more familiar Word. In both cases, the wiki was used as a repository for the document content, and was supplemented by either e-mail or forum for communication.

Subject—Rules—Object-ive

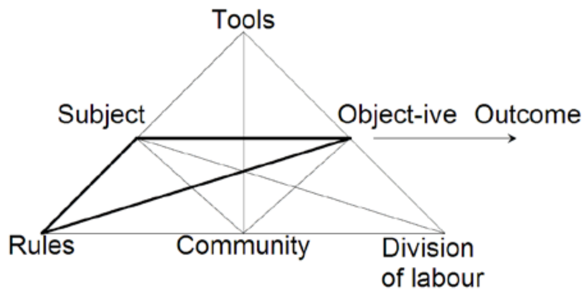

Figure 8-2: Sub-activity triangle Subject—Rules—Object-ive

The sub-activity triangle shown in Figure 8-2 focuses on how the students' working practices affected production of the assignment documents. The relevant concepts are listed in Table 8-3.

Table 8-3: Table listing Subject—Rules—Object-ive concepts

RT 1	RT 2	RT 3
The place for discussion		Concerns with security of contributions
Distinguishing contributions within a wiki		

There was much comment from the students concerning where was the best *place for discussion* about the content being written in the wiki. Despite having dedicated discussion pages, the wiki was not popular for recording discussion. In the Computing students' final examination reflective question on the wiki, the issue had sufficient impact for 21% to note that it was difficult to follow the flow of discussion. As noted in Subject-Tools-Object, e-mail was one alternative, though forums were preferred. The students were not concerned that the discussion should take place in the wiki. This is in contrast to the original intention of using a wiki's threaded mode to permit discussion to take place as near as possible to the item being discussed — in this example on a wiki discussion page adjacent to the wiki content page. In interview, the students considered the ability of the discussion tool to support their discussion to be more important than the location of the discussion. This finding matches that of Augar *et al* (2006), and supports their suggested reason for the use of a discussion tool. The students were familiar with threaded discussion tools, and this was the main tool type chosen for their discussions. The issue for the students though, was the time spent in the collaborative activity agreeing where the discussion should take place.

None of the students mentioned the need for enhanced discussion tools, such as the ability to link the discussion directly to an item within a wiki page that has been implemented in the latest version of the OU VLE. This suggests that simple wiki functionality when complemented by a dedicated discussion tool could adequately meet the students' perceived needs. Whether having the extra functionality available would make a difference will have to be the subject of future research.

The concept *distinguishing contributions in a wiki* covers two concerns. The first was to ensure the document was readable. The solution was for the students to agree suitable rules to mark out amendments. The rules took time to emerge, and could lead to confusion as seen in the wiki comments when one student used angle brackets around his name and his peers thought he was trying to write HTML in the wiki. As all groups had to evolve a rule for contributions and to highlight changes, this would suggest initial guidance would be beneficial as there was confusion until the rules had emerged. This leads to the eighth guideline.

Guideline: Provide sample rules for managing discussion relating to wiki content.

The second aspect overlaps *concerns with security of contributions*. Looking specifically at the wiki as a tool, students appeared to be concerned that the inability to distinguish contributions could facilitate plagiarism. In contrast, looking at the collaborative activity as a whole, plagiarism was not an issue because the activity included use of the wiki's audit trail. When asked in interview, the students knew that the audit trail could be used to counter any attempt at plagiarism. This contrasts with the positions of Wagner (2004) and Gonzalez-Reinhart (2007) who state that students are empowered by a wiki's open editing because the students are being trusted to contribute and not act in a malicious manner. However, the audit trail removes the need to trust, or be trusted. Hence, the students are empowered to contribute, but not in the way supposed by the two authors.

The finding about the students' appreciation of the audit trail demonstrates the importance in this research of examining the wiki as a tool in context; otherwise the students' true attitude to plagiarism might not have emerged from the analysis. That the audit trail provides reassurance about plagiarism to students leads to the ninth guideline.

Guideline: Counter possible concerns about plagiarism through demonstrating the audit trail.

In summary, the absence of rules, while true to the wiki philosophy of letting users work out how best to use the wiki, is less appropriate in the context of education. The students' progress towards completing the assignment documents was hindered due to the time it took for rules to emerge, and the consequent delay in establishing an effective discussion process within the groups. This concern applies only to wiki-supported activities in which the wiki is solely used as a tool to enable the collaboration. If exploring the use of the wiki is itself part of the course content, then rules must be allowed to emerge. The intended role of the wiki in the course will affect other guidelines similarly, as noted in the summary in the next section.

Subject—Community—Object-ive

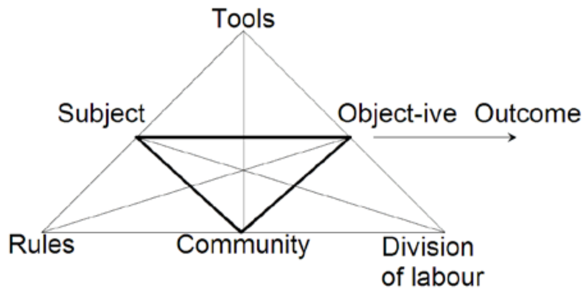

Figure 8-3: Sub-activity triangle Subject—Community—Object-ive

The sub-activity triangle shown in Figure 8-3 focuses on how the students' group-work affected production of the assignment documents. The relevant concepts are listed in Table 8-4.

Table 8-4: Table listing Subject—Community—Object-ive concepts

RT 1	**RT 2**	**RT 3**
Student socialising and forming a coherent group		Visibility of other students' contributions
Maintaining a group		Dialogue about other students' contributions
		Learning as intended

The two courses used different methods to form groups. In the Computing course, groups were defined by the course manager, in the Business course the groups were self selected by the students.

Of the 56 groups in this research, only one failed to function immediately. This group was from the first presentation of the Computing course. Following intervention by the tutor and course manager, this group successfully completed the activities without further support. That there was a problem with one group only, suggests that assigning students to groups is a reasonable method of group formation.

While there were no problems with the functioning of the Business student groups, because there were only six groups for each iteration of the collaborative activity a firm conclusion cannot be drawn because this is too small a sample. The results do suggest there could be little to distinguish between the two types of group selection in terms of subsequent group functioning. However, this requires confirmation through a larger scale study.

Despite the ice-breaker activities there was little *student socialising and forming a coherent group* visible in the wikis. The groups were pragmatic teams to write the assignment documents. Such socialisation and effort *maintaining a group* as there was, took place in e-mail and forums. This is to be expected given the student views on wikis supporting discussion.

The pragmatism also fits in with the nature of OU and other distance-education students, in that they are accommodating the course to their other commitments and so many have little time for social interaction beyond that necessary to complete the activity. That the students did not want to be involved in the group beyond that necessary to write the assignment report was seen in the few wiki and forum posts on this topic, and that no social activity outside the course was organised by any student. However, the students did achieve the necessary degree of socialisation to work as a group. As noted by a Business student in their review of the first collaborative activity, the group was good at "*rallying round to deliver to a deadline*".

The limited effort required to achieve socialisation among the students is in contrast to the recommendations of Salmon (2002) and Kiernan (2002) because this research has a different context to their work. The current research is concerned with post-graduate students studying distance education courses to support their professional development. Therefore, the students were already motivated to engage with the courses without the need for additional engagement through socialisation. The students possessed sufficient group working experience from their professional lives that they could quickly form an effective group following even the limited introductions in the ice-breaker activities. Though the student backgrounds were not investigated in detail, from the interviews all were relatively senior in their organisations. The most senior was a Director in a local council. Several students brought other experience to the course, with at least three of the Computing students being tutors on other OU courses.

The ice-breakers included writing a mini-biography of about four lines with information such as current job. This information seemed to provide sufficient introduction to their peers who they were unlikely ever to meet in person as there were not follow up questions or discussions noted. This was confirmed in the post-presentation interviews. As reported in Chapter 5, the Business students commented favourably on having to edit their peers mini-biographies. This broke the ice of any reticence about editing other contributions in the wiki later in the collaborative activities. Hence, while both courses' iced-breakers served to confirm the students' ability to use the wiki, and to introduce themselves , albeit briefly, to their peers, the Business course ice-breaker had a third benefit setting an appropriate rule for engaging with the activity.

If the groups appeared not to achieve a life of their own however, the students did report several benefits from working in a group. The most important factor leading to the benefits was *visibility of other students' contributions*. The visibility led to personal reflection, and in turn to *dialogue about other students' contributions*. The students did discuss and refine their contributions, leading several to state that the group work had led to enhanced learning and nearly all reported the interaction with their peers as a positive aspect of the course. In this respect, the self-selecting nature of the Business student groups might be considered better than the imposed groups in Computing.

One student mentioned deliberately choosing a different group in the second repetition of the collaborative activities to get away from one of her peers to whom she had taken an unspecified dislike in the first activity.

The opportunities afforded by the collaborative activities did lead to *learning as intended* by the course teams, with the students sharing their learning experiences with their peers in the group. The sharing led to discussion of topics relevant to the assignment, but not to the more wide ranging discussions as might occur in a face-to-face tutorial for example.

Therefore, the minimal ice-breaker activities in the two courses were found to be adequate to support group formation and more time need not be allocated to this and continuing socialisation within the courses. The opportunities for discussion need only to be pointed out to the students because discussion about the course content will occur without further reinforcement, while the students are generally not concerned with discussion on matters outside the course. This leads to the tenth guideline.

Guideline: A minimal ice-breaker can be sufficient for group formation with post-graduate students.

Subject—Rules—Community

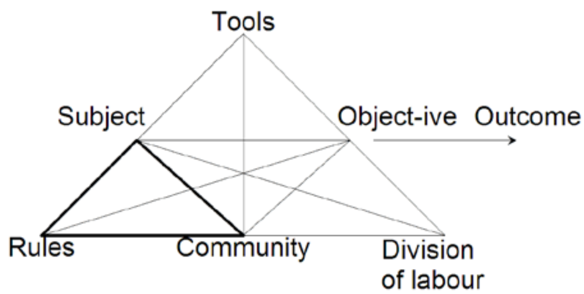

Figure 8-4: Sub-activity triangle Subject—Rules—Community

The sub-activity triangle shown in Figure 8-4 focuses on how the students' working practices affected their group-work. The relevant concepts are listed in Table 8-5.

Table 8-5: Table listing Subject—Rules—Community concepts

RT 1	**RT 2**	**RT 3**
Additional time constraints	Rules for authoring	Other learning opportunities
Establishing rules within the group		Concerns with privacy of contributions

As identified in the literature review, distance-education students often face time constraints and other external pressures, which led several to comment unfavourably on the *additional time constraints* imposed by having to depend on other group members and meet deadlines for the collaborative activities as well as the assignment submissions. As will be discussed in the next sub-section, Subject-Community-Division of labour, this remained true even when there were students and tutors raising the issue of the activity deadlines. As seen in the date stamps of the VLE logs, students worked to the assignment submission dates only. No effective rules emerged to address this issue, despite it being highlighted as a potential problem in the course guides.

Indeed, few rules emerged from any group. While the absence of pre-defined rules is part of the wiki philosophy that working practices should emerge from the users to best fit their needs, during the six months of the course, there was not the time for *establishing rules within the group*. Such rules as did emerge were purely practical and related to *rules for authoring*, for example, format of signature to identify contributions.

The lack of formality meant there were no *concerns with privacy of contributions* because everyone in the group was equal. In contrast, the lack of rules seems to have discouraged *other learning opportunities*, as students hesitated to take on new tasks, such as trying to be a project manager, in the absence of formal mechanisms for co-operating with their peers. Though within the context of the time available in the course, it is to be questioned how realistic it was for the students to learn more than the core course concepts. It is note worthy that only two of the students interviewed mentioned additional learning as a desirable goal.

In summary, the absence of pre-defined rules did not appear to affect adversely student involvement within the group. If a course team's intention is for the students to explore the characteristics of a wiki, then this should include allowing rules to emerge as intended by Ward Cunningham's original vision. However, if the course team's intention is for the students to concentrate on producing a document then sample authoring rules could allow the students to focus on that task more quickly because they would not have to negotiate and agree the rules as they emerged during the activity. This leads to the eleventh guideline.

Guideline: Provide sample rules for collaborative writing in a wiki.

Subject—Community—Division of Labour

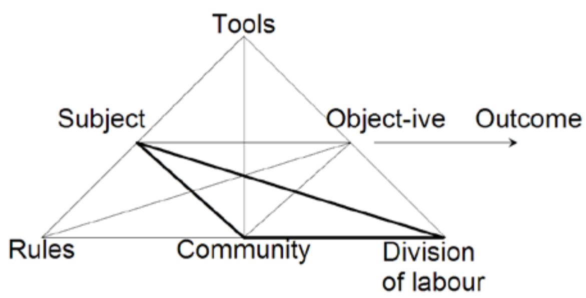

Figure 8-5: Sub-activity triangle Subject—Community—Division of Labour

The sub-activity triangle shown in Figure 8-5 focuses on how the students' group-work affected roles within the group. The relevant concepts are listed in Table 8-6.

Table 8-6: Table listing Subject—Community—Division of Labour concepts

RT 1	RT 2	RT 3
Roles within the student groups	Roles for authoring	
The role of the tutor		

Neither of the courses in this research assigned roles to students in the groups. The courses are aimed at post-graduates and so the course teams expected the students to be self-organising. Feedback from the students, both in reflective answers and interview, indicated that they shared this expectation. Generally, though, the Business students were better organised, suggested by less discussion in the forums around the practical problems of organising the group. Following up in interview, the Business students attributed their ability to organise in part to their Masters programme that includes aspects of group work in its other courses. It may also be due to the preliminary exercise in which the Business students assigned themselves to groups but nothing conclusive was found to support this hypothesis. However, the *absence of roles within the student groups* was not a factor reported by any student or tutor as preventing the progress of any of the 56 groups.

It should be noted that one group in the first presentation of the Computing course did initially fail to function effectively. The absence of communication among the group members and contributions to the wiki was noted by their tutor and course manager who intervened to help the group start on the activities. Following the intervention, the group successfully completed the collaborative activities and assignments without further guidance.

While there was no discernable pattern, most groups had one or more members who took on a leading role encouraging their peers to engage in the activity and to co-ordinate contributions when necessary. These students emerged informally from within the groups, and no dominance by them or hostility towards them was found in this research. On the contrary, the individuals who did co-ordinate the groups were appreciated by their peers as noted in wiki posts and confirmed in interview.

Formally, the two courses had different *roles for the tutors*. The Computing tutors were not to be involved with the collaborative activities. However, they all took an active interest and encouraged contributions as necessary. The Business tutors were expected to encourage their students, and also contributed directly to the ice-breaker activity. The nominal difference in tutors' roles seems to have produced no discernible difference in student behaviour as judged by measures such as timing of contributions to the assignment documents. Analysis of the VLE logs shows that the published timetables and guidance for contributing to the documents were ignored in both courses. Peak activity was recorded in the three days before assignment submission dates and not before the suggested collaborative activity completion dates.

In three of the Business groups and five of the Computing groups, students took on a self-appointed role as editor to produce a common format for the group's report, each contribution being slightly different otherwise. The course teams had designed the activity so that there was no need for any *roles for authoring* because it was the report's content that was to be assessed, not its presentation. Nevertheless, the expectations of the students regarding their documents were such that they chose to devote time to the task.

The absence of defined roles within the groups did not hinder progress towards producing the students' documents as assessed by comments in wiki posts and inferred by updates recorded in the VLE logs in which the dates were clustered around the deadlines. This suggests that in line with the expectations of the course teams, guidelines on roles are not necessary when working with post-graduate students.

The next section presents a commentary on the guidelines identified in the synthesis discussed here.

8.3 Summary of guidelines

Table 8-7 presents a summary on the guidelines identified in Section 8.2. Two caveats should be noted when considering the guidelines. Firstly, they apply to post-graduate students who are bringing their professional experience to the course, especially for group working. Secondly, they apply to a course in which the wiki is a tool for the production of a collaborative document and is not the object of study itself. Hence, the provision of samples will not be appropriate in courses where the students are meant to be finding the best use of a wiki for themselves, and requires the to define wikis' structure and layout as they use the wiki.

Table 8-7: Summary of guidelines

Guideline	**Comments**
Use a simple wiki to produce documents as part of collaborative learning activities.	Producing a shared document provides a focus to a collaborative activity and contributes to the implementation of social constructivist pedagogy in the course. A simple wiki lacking sophisticated features can be a useful tool, suitable for students to produce a document collaboratively. Using a simple wiki avoids issues with installation, training and support all of which can consume time from the course schedule that could otherwise be spent teaching the course materials. However, it requires the shared document to be within the scope of the wiki's functionality and potentially constrains the course pedagogy, as rich learning materials may not match the functionality of the simple wiki.

Guideline	Comments
Supply examples of relevant wiki use to encourage engagement with activity.	If possible, use example wikis from the domain being studied to reinforce relevance of the tool to the students. This is part of social constructivist pedagogy and its approach to authentic learning. The different levels of motivation between the Computing and Business students were a product of a discrepancy in their view of the relevance of the wiki to their collaborative activities.
Set expectations about available wiki features.	Ensure the wiki used as an example has content that matches the feature set available to the students so as not to set the wrong expectations. Wikipedia may be considered a bad example in this context as there is unlikely to be the time available within a course to produce so polished a product with images, column layout and sophisticated navigation even if the students' wiki is capable of supporting such features. In that sense, Wikipedia is not an authentic example of a wiki for the students.
Provide template and structure appropriate to the intended output.	There is not time in the course for a wiki structure to emerge from the students' work. To help the students be productive within the time constraints of a course provide some form of structure and/or template for their wiki contributions. In this study, the students were engaged in activities whose could be defined, as is true of most educational collaborative activities. This has the added benefit of setting the students' expectations as to what they can do with the wiki. This is particularly relevant to students who are not used to writing online documents because it can prevent problems such as a wiki page extending over 20 screens and thereby being quite unreadable. The Computing course provided a simple five-line Volere shell template for documenting requirements. This method of documentation is the one taught in the course materials and specified in the set text. Hence, the student groups did not have to lay out their own requirements template, and agree its format, but could immediately move to populating the supplied template with proposed requirements. The wikis in the ice-breaker activities in both courses were seeded with simple templates in the form of suggested questions to answer and a simple structure in the form of a home page.

Guideline	**Comments**
Consider using the wiki as a document repository Content Management System.	A wiki makes for an effective CMS that is easy for students to use, including by those students who have not encountered a CMS before. Using a wiki as a CMS makes it easier for students to use other tools with which they are already familiar, such as Word for writing documents, thus lowering the barrier to engagement with the learning activity, while still gaining the other benefits of a wiki such as an audit trail of contributions, change control and backup recovery. For many of the Business students in this study, they came to see the wiki was an authentic tool as a CMS because they could relate it to the document management systems they encountered at work. Used in this manner, the wiki still contributes to the social constructivist pedagogy of the course.
Include personal reflection in the activity.	The ability to see other peoples' contributions on the same topic, with possibly different interpretations or different presentations of the same material, is a valuable opportunity for the students to refine their own understanding of the course material. This should be explicitly stated in the course materials, so giving the students explicit permission to review their peers' work. It can also be incorporated into the ice-breaker activity by having the students comment on or ask questions about their peers' biographies. Reflection was included in the two courses studied in this research because the courses applied social constructivist pedagogy, and the reflection was reported by the students to be beneficial.
Use a dedicated discussion tool to supplement the wiki.	The discussion does not need to be in the wiki. A usable tool is considered more important by the students than proximity to the issue being discussed. This study has found that the students prefer to have multiple tools in the activity, rather than have the one tool for several tasks.

Guideline	Comments
Provide sample rules for managing discussion relating to wiki content.	Some sample rules can help the students be productive quickly because they can avoid the confusion caused in the document by it having multiple mark-up schemes. While the detailed rules will vary with each activity, generic rules that emerged from this research are: • format of signature in wiki updates - initials within angle brackets proving popular and is distinctive within the text; • all contributions to have date and time stamp with a defined format, e.g. day-date-month-year; • all contributions are to be appended and not inserted to the discussion flow; and • e-mail headers to include a defined tag to identify the mail as relating to the course. In this research the preference was for a combination of course number and TMA number, though this is OU specific. The header tags can also be used in e-mail systems to automatically file the e-mail in a dedicated folder.
Counter possible concerns about plagiarism with audit trail.	Allay concerns about plagiarism through explaining the wiki's History function. Though the function is primarily intended to provide course teams and tutors with a means to confirm contributions, the facility means that plagiarism is easily tracked too. Highlighting this will encourage the students to participate because they know their individual contributions to the collaborative activity can still be identified and credited in the assessment.
A minimal ice-breaker can be sufficient for group formation with post-graduate students.	An ice-breaker is useful to introduce the students to each other. It also introduces the students to the wiki and helps to set their expectations for wiki use. However, the time needed for an ice-breaker activity need not be that great. The groups in this study were composed of post-graduate, distance-education students. The groups needed only limited socialisation to be productive in a collaborative activity. The students did not need, nor did they wish, to engage in social interaction outside the course. Allocating more time to the ice-breaker to encourage group cohesion is unproductive.

Guideline	Comments
Provide sample rules for collaborative writing in a wiki.	Some sample rules can help the students become productive quickly because they will not have to work them out for themselves. The rules follow on from those set out for managing discussion. In addition, useful rules identified in this research are: • e-mail notification of updates, with suitable tag word in the header; and • a simple form of contribution tracking through documenting task assignment and progress in a wiki page.

8.4 Conclusions

The in-depth, multi-data study presented in this dissertation is generally supportive of the findings of the previous, smaller scale studies reported in the literature review. It has provided extra information to extend those findings, for example, to confirm Augar *et al*'s (2006) suggestion that one reason why students prefer a dedicated discussion tool to hosting discussion in a wiki is that they are already familiar with dedicated discussion tools.

This dissertation investigated the use of a simple wiki, with its two unique features of simplicity and flexibility, to enable collaborative learning activities.

Simplicity appears to be a benefit in collaborative learning activities. The students were not distracted from the course materials by having to install wiki software, nor by having to learn the basic features of the wiki. Used in a collaborative learning activity designed to match the simple wiki's features, the wiki was effective in enabling the students to contribute to the activity and to make the contributions available for discourse and reflection. Hence, the simple wiki can be an appropriate tool for applying social constructivist pedagogy. To be effective in this role, the wiki does not have to be used as an authoring tool, but can be used as a Content Management System that permits the collaboration and sharing of ideas that forms the core of social constructivist pedagogy.

In contrast, a wiki's flexibility appears to cause problems in the context of collaborative learning activities. In devising the wiki, Ward Cunningham intended that its flexibility would allow users to define a structure and style to best meet their needs. However, the time available during a course means that students do not have the time to let structures and styles emerge. The matter is complicated in education, when the students may be learning the processes as part of their course, as was the case with the Computing students. The students in both courses eventually agreed structures and rules for their working practices, but for the students to make early progress in the activities some initial guidance is required. Hence the provision of a template in the Computing course, for example.

The wiki alone, however, does not appear to be sufficient to support collaborative learning activities. While it is a good medium for hosting content, it is relatively poor at hosting the discussion about that content. From the students' perspective, other, dedicated discussion tools are better for this task. That the discussion and the content being discussed are in different tools does not appear to hinder the students' contribution to the collaboratively authored documents.

One benefit of the wiki towards collaboration is the presence of an audit trail. Expected to be useful to tutors to confirm students' contributions, it also proved of benefit to students by re-assuring them that their contributions could be authenticated, and negated the risk of plagiarism. Hence, the audit trail established the students' trust in the wiki as a tool when writing documents for assessment.

In one area though, this research reports a contrast to previous research: socialisation. In this research, minimal socialising in an ice-breaker activity was sufficient to produce a group capable of completing the main collaborative activities. The finding is due to the particular context of the present research. Working with post-graduate students taking the courses as part of their professional development, they did not need to socialise extensively to form an effective group. They already had the skills to form quickly a functioning group. In addition, the research was concerned solely with distance-education. The students had no desire to extend the social aspect of the group outside their studies because no direct social interaction was practical. This research suggests that for post-graduate distance-education courses relatively little time within the course needs to be allocated for establishing a functioning group.

This chapter has presented a synthesis of the findings reported in Chapter's 5, 6 and 7 and in Section 8.3 provided a summary and commentary on the guidelines that are the prime contribution of this research.

The final chapter concludes the dissertation with a review of the research questions and the dissertation, including reflections on the methodology used in this research, the limitations of the research and future work.

Chapter 9 Review, reflections and future work

9.1 Introduction

This dissertation concludes with a review of the research questions and emergent guidelines in Section 9.2. This is followed by a review of the validity and reliability of the findings in Section 9.3. Section 9.4 examines the four key differences between the courses. Section 9.5 examines the changes that have been made to the courses after data gathering for this research was complete. In Section 9.6, the updates to the wiki since the data gathering was completed are discussed. Section 9.7 records suggestions for future work, and is followed by the conclusion.

9.2 Review of research questions

Are wikis a usable medium for collaboration in an educational context?

The primary challenge in the use of any software tool is normally its installation. Wikis avoid this challenge through running wholly within a web browser. All students already had a working web browser, and used it successfully to access the course web site. There were no reported problems regarding access to the wiki software in the course forums, nor did the issue arise in the post-presentation interviews with the students and tutors. Thus, we can infer that the wiki might pass the first hurdle in being a usable medium, with the usual caveat that absence of evidence is not the same as evidence of absence. The rest of this sub-section explores the question in more detail.

The students knew from the course descriptions available before they chose the course that they would be using a wiki in the course, and that its output would be used in their assessments. Hence, this research cannot assess the role of a wiki as a tool in student motivation, because the students were self-selecting and there is no control group. Note, motivation will be considered later in terms of the wiki supporting an authentic activity.

As reported in Chapter 4, relatively little use was made of the online training materials. The issue of training did not feature in the forums, while in the interviews the students confirmed sufficient information had been made available to them. This extends to the Business students, when they began to use the wiki as a CMS rather than use the wiki in the way intended by the course team and write the report's content directly into it. There was discussion with the tutors to confirm this practice was acceptable and would still count for assessment; however, there was no discussion as to how to use the wiki as a CMS.

Training as an issue did arise when students attempted to move beyond the supplied wiki features. For example, those Business students new to Facebook requested help from their peers once their group had decided to use Facebook to host images.

The students on both courses were for the most part content with the built-in formatting features. As described in Chapter 6, there was a challenge in setting the students' expectations about the limited features of the wiki in the courses. Hence the guideline "*Set expectations about available wiki features.*" The majority of students made some use of the built-in formatting, at least to distinguish titles from text. Some Computing students used their outside experience to produce sophisticated layouts and structures within their group's wiki web site. As noted in Chapter 5, this included coding raw HTML in the wiki pages.

As described in Chapter 5, the students found the wiki to be an effective medium to record and share content. The content could be stored directly in wiki pages or indirectly by using the wiki as a Content Management System. For both options, the students valued the content storing role of a wiki because they knew where the content was, and that it was always the latest version. The differing preference for each option seems to be derived from the students' varied outside experience. Some Computing students would use HTML in their pages; the Business students would use Word to author their report. That both groups of students could make use of their outside experience without additional training or intervention to apply that experience in the course indicates the suitability of a wiki when used in an educational context.

That the use of the wiki as a CMS was valid for the Business students and enabled them to achieve all that was required from the collaborative activity leads to the guideline "*Consider using the wiki as a document repository Content Management System.*"

The advantage noted immediately above further reinforces the beneficial consequences arising from a wiki's simplicity. Students do not have to devote time to mastering the mechanics of using a wiki. This means there remains more time for students to engage with the course content. The absence of installation and training issues is of particular benefit to students studying in a distance-education context because these issues cannot be resolved face-to-face. Hence the guideline "*Use a simple wiki to produce documents as part of collaborative learning activities.*" That a wiki is ultimately a usable medium in an educational context is shown by the fact that all 56 groups in this research successfully collaboratively produced the output from their wikis required for assessment.

Can a wiki enable a social constructivist activity?

Social constructivist activities have three elements, discourse, authentic activity, and reflection (Farrell, 2005).

As noted in the previous sub-section, the students were able to use the wiki to store the content they produced in the activities. However, the students had problems engaging in discussion among themselves about the content and their evolving understanding of the course materials.

The students found the wiki less useful for discourse and subsequent refining of the wiki content because of their difficulties in following the development of ideas on a wiki page. The students also reported the practical problem of knowing when an update had been made to the wiki. Hence the guideline "*Use a dedicated discussion tool to supplement the wiki.*" The preferred solution was to send an e-mail notification. As the students were already using e-mail, and were familiar with it, there was a strong tendency for discourse to move to their preferred e-mail tool. Thus, the wiki did not enable discourse within the wiki web site, but had to be supplemented by a dedicated discussion tool.

All students recognised the collaborative activities as authentic. This was particularly so for the Computing students who studied papers describing RE and wikis in industry as part of their first TMA. The Business students, however, had mixed views. They recognised the task as being authentic, but not the tool. Hence the guideline "*Supply examples of relevant wiki use to encourage engagement with the activity.*" However, the wiki was still able to support the Business students' use of Word to their benefit in the collaborative activity as acknowledged in interview by several Business students.

The students did appreciate how a wiki enabled reflection. The wiki was an easy tool for the students to use to view their peers' contributions. This allowed the students to reflect on those contributions and to see how they differed from their contributions. There was also the potential for personal feedback on the contributions as well as the more formal discussion and development of the contributions as part of the authoring task. As reported in Chapter 7, some students went further and discussed the course concepts that informed the activity too. Hence the guideline "*Include personal reflection in the activity.*"

There was formal reflection required in both courses. In the Computing course, the reflection included thoughts about the wiki itself, and its role as a tool to support RE, as well as reflection on the RE process. The Business students had to reflect solely on applying the management problem studied to their workplace. However, all reflection required support by extracts from the wiki. All students met this requirement.

Of particular note is the benefit reported by the Computing students of being engaged in an authentic process. This is described in Chapter 7, and is perhaps best illustrated by repeating this quote:

> *"I think I learnt more about requirements engineers than about requirements engineering process in many ways." [CS7 interview]*

As described by the Computing students in interview, the wiki provided a rich source of material for informal reflection during the course as well as the formal reflection required for assessment.

An underlying assumption in social constructivist learning is that learners are actively engaged (Farrell, 2005). A wiki's informality should 'lower the barriers' to entry to the activity. That a wiki is usable has been covered in the previous sub-section. In addition, a wiki should be usable by all equally. This was Ward Cunningham's original concept for users of a wiki (Leuf and Cunningham, 2001). It was also desired by the course teams for the activities so that all students would equally benefit. The VLE logs show there were no dominant users, though many examples of more active users. As noted in Chapter 6, some students volunteered to edit and format the group's wiki web site.

However, there were no passive lurkers in any group. The activities were designed so that the students would be active participants, and the students were.

In summary, the wiki has a mixed record on enabling a social constructivist activity. The wiki appears to be poor at supporting discourse, and the students prefer to use another tool for that task. A wiki can provide an authentic task, but only when an authentic task is available. For computing science education, there are authentic tasks from software engineering that can be applied in education. Wikis can be successful at supporting reflection, because they provide a shared working environment where contrasting ideas and practices are exposed. A particular benefit in computing science education arises when the wiki is implementing an authentic activity, as in this research, for then the students can reflect on the working process too. Finally, a wiki enables all to participate and be active learners. Thus, a wiki can directly enable some of the elements of a social constructivist activity.

What are the challenges in using a wiki in a social constructivist educational activity?

This sub-section considers how the wiki, as a tool, can be made a part of a collaborative learning activity. Providing a tool to enable the activity is not sufficient. The first element identified in the literature review presented in Chapter 2 is student engagement through becoming part of the wiki's user community.

In part, the students have no choice but to engage with the wiki because both courses studied in this research used wiki output for assessment. However, the students did have a choice as to how they engaged with their fellow students and collaborated with them. Socialisation is intended to aid group formation and retention (Salmon, 2000). To aid socialisation, both courses included wiki-based ice-breaker activities. As noted in Chapter 5, these activities were reported as successful by the students in terms of learning something about their fellow students. Something of particular concern in distance-education where face-to-face meetings are difficult if not impossible. However, the students did not become a community of learners, but remained a pragmatic group collaborating on a specific output. The students did not socialise, in the general sense, outside the immediate requirements of the course.

The ice-breakers appeared to serve the course teams' intention for them within the courses. The students did collaborate within their groups to the degree needed to complete the activities successfully. However, as noted in Chapter 5, the students in this research were all post-graduates, and where expected to bring their outside experience of group work to bear in their studies. Thus, the minimal ice-breakers used in the two courses appeared to be sufficient for group formation. Hence the guideline "*A minimal ice-breaker can be sufficient for group formation with post-graduate students.*"

There was one difference between the courses' ice-breaker activities. The Business students had to comment by editing their peers' contributions. The course team intended this to get the students used to editing the wiki. However, as the students reported in interview, a greater benefit was that it gave the students permission to edit other people's contributions, and so they had no reticence about editing each other's work later in the report writing activities.

An additional element of socialisation is gaining trust in one's peers. However, the students in this research did not require gaining such trust. The students realised that the wiki's audit trail meant that all work was recorded. The audit trail was intended by the course team to confirm student contributions matched those claimed in their assessment submissions. The students used as a substitute to establishing trust with their peers. Any false claims to contributions, or malicious changes, would be recorded.

Thus, the challenge to collaboration through needing to trust one's peers was overcome through using a wiki. Hence the guideline "*Counter possible concerns about plagiarism with audit trail.*"

A wiki's inherent simplicity and flexibility, and the consequential lack of initial structure and layout were also identified as a challenge in the literature. While the students eventually produced both, more guidance to the students through providing templates would enable them to be more productive, more quickly, instead of devoting effort to establishing these practices. Hence the guideline "*Provide template and structure appropriate to the intended output.*" Similarly, a wiki imposes no working practices on its users. While the students eventually produced their own rules for writing the required documents, suggesting rules would enable them to be more productive, more quickly. Hence the guideline "*Provide sample rules for collaborative writing in a wiki.*" The provision of templates and rules is easier when a wiki is used in an authentic activity. As noted in the literature review, the wiki is then being used as a tool to implement known procedures. If these procedures are already proven, then they should be adapted to the wiki. This solution was adopted by the Computing course team during the period of this research to provide a requirements template to their students.

The Business student groups' use of their wikis as a CMS is in a similar vein. They are using the wiki in a familiar manner to act as a document repository for their report written in Word. As with the computing template, this agreed use of the wiki took time to emerge during the course and had to be negotiated.

The potential challenge of unequal users, especially those who do not contribute, did not emerge in this study and has been covered in the previous sub-section. The requirement for all students to use the wiki to provide material for their assessment submissions meant that none could act as a lurker. Therefore, all learners in this research were necessarily active learners, and this research cannot address the challenge of passive learners.

The literature highlighted a couple of examples when the course materials led to disengagement by the students with the course, and by the students with the collaborative activities too. This challenge did not arise in this research. This is probably due to the OU's established review practices when creating course materials, and continuous feedback thereafter once a course is in presentation. Therefore, this research cannot address the challenge of poor supporting materials.

The final challenge noted in the literature was integration of complementary tools. As noted in the previous sub-section, a wiki should be supplemented with a tool better suited to supporting discussion. Ensuring the tools can work together is important. Hence the guideline "*Provide sample rules for managing discussion relating to wiki content.*" This was true in the context of this research because effective communication is a pre-requisite to supporting distance-education students. The students were provided with alternative tools to meet their needs for discussion.

Neither course made use of extensions within the wiki to enable additional features. The activities were designed to be within the capabilities of the wiki. The Computing students worked to that constraint, the Business students did not and time was diverted from the course for them to access Facebook. Hence, the importance of clarifying the expectations of, and suitability of, the wiki's features to the students.

In summary, those challenges of using a wiki in a social constructivist activity encountered in this research can all be successfully addressed.

To conclude, a wiki-enabled activity can facilitate collaboration among students. The results of this research can demonstrate that a wiki is usable by the students. The students need a minimum of support. A wiki can directly enable some aspects of social constructivist activities, and can indirectly support all by providing a central repository for student contribution. The wiki can be used as an authoring tool in its own right, or as a Content Management System for hosting documents written with another tool. A benefit of the common repository highlighted by the students as being important is that it enables them to view their peers' contributions and to use that to reflect on their own contributions. There are challenges when using a wiki in a social constructivist activity. Of those identified in this research, all can be addressed.

The two courses were informed by social constructivist pedagogy in designing the course wiki-enabled collaborative activities. However, the two course teams had different intentions for the collaborative learning opportunities in their courses. In the Computing course, the students were to share their experience gained during the course. In the Business course, the students were to share their experience from outside the course. This research found examples of each intended sharing style in the appropriate course, thus indicating the flexibility of a wiki when used to support collaborative learning activities.

9.3 Review of the reliability and validity of the findings

This section presents reflections on aspects of the research.

Validity of the findings

The validity of the findings presented in this research is based on the data gathering methods adopted to ensure the appropriate data was available for analysis.

The research is concerned with the use of a wiki to support collaborative learning activities, therefore the initial data gathering exercise was of wiki content developed in a Computing course. To aid understanding of the wiki content, the students' discussion in the course FirstClass forum was also collected for analysis. An inductive data analysis of this initial data set was reviewed. From the analysis findings and subsequent review, the decision was made to add post-presentation surveys and interviews to the data gathering methods to allow further exploration of issues identified in the inductive analysis. The additional post-presentation data gathering enabled confirmation of interpretations made during the inductive qualitative analysis.

Reliability of the findings

For reliability, the data gathering exercises were repeated in a second presentation of the same Computing course, and repeated in a different domain in the Business course. The data was drawn from over 50 wikis, 239 students and nearly 20 members of staff. The resulting large data set provides a breadth that enhances the findings of this research and addresses a criticism of some of the papers reported in the literature review.

As described in Chapter 3, a variety of techniques were used in the data gathering and data analysis. This variety allowed triangulation across the data to confirm findings. The principle led to the choice to collect quantitative data in the form of VLE logs. One Computing student in the first presentation was particularly hostile to the wiki stating in his examination answer that it is very unreliable. However, he could not provide a specific example to support his statement as specified in the question. On checking the VLE logs to review his use of the wiki, it was noted that he was the one user on the wiki at the time the server hosting the wiki crashed. The problem was not with the wiki, but with the server. However, that experience of the wiki apparently failing while he was using it, had affected his perception of the wiki thereafter and he used it far less afterwards. He had not been able to tell me about the incident, but the evidence was in the data, and I could see that it was a one-off problem and not a case of repeated unreliability.

Similarly, analysis of both the wiki as a tool, and as a component in an activity has proven useful. As reported in Chapter 5, many students considered sharing contributions in the wiki would expose them to plagiarism, with others taking the credit for their work. However, as reported in Chapter 7, in the context of the activity, the students were aware of the audit trail for tutors to verify contributions. Thus, a problem reported in the wiki in one chapter is resolved by the activity in another. This supports the decision to collect and subsequently analyse source data from multiple viewpoints.

Changing student perceptions

The initial findings of the research provoked surprise when reviewed with the Business course team. There was a marked contrast in statements made in e-mail and forums during course to those made in the interviews after. One student in particular had been very critical of the wiki during the course, especially as a writing tool, but afterwards with time to reflect on the course team's intentions and without the pressure of producing assignments, was much more positive about the experience. The evidence was robust enough for the researcher to explain the discrepancy to the satisfaction of the course team.

It was noted that there were several other examples of students modifying their views on the wiki and the activities after completing of the course, with all becoming less critical. Discussion of this change in view in the interviews indicates that the same reason this change in view as noted above: during the course the students were focused on the need to deliver the assignments to schedule. Any failing of the wiki that hindered progress to completing the assignment led to frustration. In the interviews, the students were encouraged to reflect on wikis and collaborative activities in a wider context. In the absence of time pressure, the students were able to articulate the benefits of the wikis and the collaborative activities and consider what they had gained from the experience.

Caveat on the use of reflective questions

The research also produced one apparent example of a student who did not provide an answer to a reflective question based on their experience, but on what he thought he ought to say.

This research made use of data gathered from reflective questions incorporated into the students' assignments. Thus, all students who completed the course should provide an answer to the question, and so contribute to the research data. One student's answer in the examination was too good to be true. The student's response to being asked about the possible benefits of using a wiki was very enthusiastic. His answer includes positive comments such as:

> "[Wikis foster] the habit of regular reflection."

Wikis also provide a mechanism to record:

> "…[the] justification of opinion and decision and thus spreading of knowledge between the collaborators."

Moreover, that they afford the opportunity to expose:

> "…understanding or misunderstanding of conceptual knowledge."

These answers closely resemble content taken from the course material and suggested reading matter. The student's statements were not backed up with personal reflection as required in the marking scheme. This meant that the student did not gain many marks for his answer. It also meant his enthusiastic replies could not be considered in this research as there was no supporting personal experience. This highlights a necessary limitation when writing a research question for inclusion in assignment and the care necessary to follow up a student's answer.

Limitations of the research

Domains used in the research

The research drew data from two domains, Computing and Business. The Computing domain was chosen because of the growing use of wikis in software and requirements engineering in industry. Therefore, there is a need in computer science education to expose students to wikis. This would also make it easier to assess the application of a wiki in an authentic learning activity inspired by constructivist pedagogy. The Business domain was chosen because of the contrast the Business course and its students afforded to this research, as described in more detail in chapter 4.

One assumption inferred from the literature was that computer science students would be relatively familiar with wikis, whereas students from other domains would not. Therefore, data was gathered from a contrasting domain to examine whether the different experience of the students would be significant. While some differences were observed it is a matter of conjecture whether similar results would be obtained from other domains. Some domains might be more like the Computing domain while others might be more like the Business domain.

Socialisation among the students

All data in this research is drawn from post-graduate students. This may account for the discrepancy between the findings of this research and the work of Salmon (2002) and Kiernan (2002) regarding the amount of socialisation required to enable individuals to form and sustain a group.

It should be noted that the post-graduates were drawn from professional development courses, in which the students are expected to be employed and so bring outside skills to the course. Therefore, the students in this research might not be representative of post-graduate students at other universities, where many are graduates who are immediately following up their undergraduate studies with a Masters degree. Motivation is internally generated, as expressed in this interview comment made by a Computing student when recalling that he was not keeping up with the work:

> *"Oh Lord! I'm not doing this. I'm letting other people down." [CS8 interview]*

The discrepancy might also be explained by the OU delivering distance-education only. Therefore, its students, at whatever level of study, are more familiar with forming groups as part of on-line courses.

Note, despite the experience of group work the post-graduates brought to their studies, they were still found to benefit from templates and guidance to establish effective working practices.

A further possible explanation for the discrepancy might be the nature of the collaborative activities in the two courses rather than the nature of the students. The activities called for sufficient discussion to reach agreement. Other activities may make greater calls on the amount of interaction required of the students, and therefore would make greater demands on the students' ability to form and work in groups.

Engagement with the wiki

The research could not assess the question of engagement with the wiki because both courses used the wiki in the course assessment. This was to ensure all students participated in the collaborative activities. The course teams did not want lurkers among their students. The course teams for both courses had adopted constructivist pedagogy. Therefore they wanted their students to participate in the activities to maximise the learning opportunities. The students were to be active learners, not vicarious learners.

The students had no option but to use the wiki in some form within the collaborative activities studied in this research.

Applicability of the guidelines

The guidelines produced from this research are derived from a study in distance-education with mature students. They should be applicable to other delivery formats with other students because the research has elicited the motivations behind the observed patterns of wiki use. The variety of the data gathering methods used, the confirmation of interpretations found in the inductive qualitative analysis through post-presentation semi-structured interviews and surveys, the extended data gathering across two presentations of the Computing course and across the domains of Computing and Business education, provides confidence in the validity and reliability of the motivations reported in this research.

One educational approach not applicable at the OU is blended learning. In a blended learning environment, students meet face-to-face as well as interact online. Guidelines that concern solely online matters, such as *rules for authoring*, can be used unaltered. However, the guideline to *provide sample rules for managing discussion relating to wiki* *content* would have to be extended to cover both online and offline discussion because blended learning affords both forms of discussion. , and how to record them as required for later reflection or review.

The findings of this research suggest that some of the benefits of a wiki might be lost in a blended learning course. If discussion about the wiki content, and any decisions, takes place outside the wiki it is not available for later review and reflection. In this research, all discussion outside the wiki was accessible by the students, usually in e-mail of forum archives. Transcripts of Skype discussions were copied into the wiki. Thus, one benefit of a wiki could be lost because it would no longer hold all of the information that led up to a decision unless a group member took on the task to minute the meetings and post the minutes to the wiki.

Applying the guidelines to students without work experience and an expected lesser ability to form groups than the students in this research, for example undergraduates at conventional face-to-face universities, would need to take note of the students' differing needs for socialisation and greater support in those guidelines where outside experience is noted as significant.

Contributions of the research

The research has answered the three research questions set out in Chapter 2. The results of the research have been manifested as a set of guidelines for educators to design wiki supported collaborative activities.

The findings from this research were reviewed with the course teams during the analysis and afterwards through a series of "closing the loop" meetings timed with the completion of subsequent presentations of the two courses. The take up of the guidelines by the course teams is discussed in Section 9.6.

The findings have formed the basis for the following journal article and conference papers:

- *The effective use of a simple wiki to support collaborative learning activities*, Thomas, P., King, D. and Minocha, S., (2009), *Computer Science Education*, *Special Issue on Social Technologies in Computer Science Education*, **19**(4), pp.293-313.
  Available from http://oro.open.ac.uk/19274/.

- *Wikis Supporting Authentic, Collaborative Activities: Lessons in Usability*, Thomas, P., King, D., Minocha, S. and Taylor, J., ALT-C 2008, Leeds, UK, 9-11 September 2008.
  Available from http://oro.open.ac.uk/16200/.

- *Collaborative Authoring and Learning in a Wiki Environment*, Thomas, P., Minocha, S., King, D., Taylor, J., Sclater, N. and Schencks, M., IADIS 2007, Lisbon, Portugal, 6-8 July 2007.
  Available from http://oro.open.ac.uk/16278/.

- *Collaborative Learning in a Wiki Environment: Experiences from a Software Engineering Course*, Thomas, P., Minocha, S., King, D., Taylor, J., Sclater, N. and Schenks, M., ALT-C 2007, Nottingham, UK, 4-6 September 2007.

The presentation at ALT-C 2008 led to an invitation to discuss the findings with Colin Addy, Director of IT Services at the University of Wolverhampton. The discussion resulted in Mr Addy preparing internal guidelines on the use of wikis in courses, especially with respect to the impact of adding extra features such as image support, that are not present in the underlying wiki.

The thesis was reviewed by members of the M253 Team working in distributed environments course team. M253 is a compulsory course in the undergraduate computing curriculum at the Open University. It is studied by around 450 students per year over two presentations of the course, in what would be a student's second year of study at a conventional university. Wikis were introduced on M253 as one of the collaboration technologies that teams could use when the course changed from using FirstClass to the OU VLE in 2007. The M253 course team recognise that this introduction of wikis would have been more successful had they been able to use the guidelines presented in Chapter 8. For example, the benefit of providing a template for students to use, the possibility of using a wiki as a content management system and the benefit of providing sample rules for writing in a wiki are just three of the guidelines that the M253 course team would have used when incorporating wikis into M253. As the replacement for M253 is currently being produced, these and the other guidelines in Chapter 8 will influence the design of the replacement for M253.

9.4 Review of the differences in the course collaborative activities

As identified in Chapter 4, there were four key differences in the collaborative activities between the Computing and Business courses.

Choice of tools

In the Computing course, it was intended that all work would be in the wiki, be it planning the requirements, writing the requirements or discussing and refining the requirements. In contrast, the Business course supplemented the wiki with the VLE forum for discussion.

The tool choice did not prove to be a significant difference between the courses because the students negotiated their own group-level choice of tools with supporting working practices and rules. Significant though, was that while there are examples of the Computing students following the Business course design and using other tools to supplement the wiki, there are no opposite examples in which Business students adopt the Computing course design and concentrate all of their work in the wiki alone. These observations suggest that students prefer to supplement their wikis. The motivations behind this behaviour were explored in Chapter 5.

Support provided by the tutor

Computing tutors had no formal role in the activities; Business tutors were to supervise progress and advice as required.

The difference in notional support did not prove to be a significant difference in practice because the Computing tutors provided the same level of assistance to their groups as the Business tutors. There was no difference in behaviour to analyse. It should be noted, however, that students from both courses followed OU culture in seeking advice from the tutors, such as confirmation on the use of the wiki as a CMS and not as an authoring tool. This is a normal OU tutor role for a tutor and not specific to the collaborative activities. This aspect of OU culture, and the maturity of the students, they were all post-graduates, make it difficult to draw more general conclusions about the role of the tutors. This could be the subject of future research.

Method of group selection

Computing groups were defined by the course manager, whereas the Business groups were self-selecting.

These differing methods of group formation did not appear to make a significant difference because all 56 groups were able to complete the collaborative activities. As noted in Chapter 8 only one group, from the first presentation of the Computing course, required intervention for it to function effectively. However, as there were only six groups for each iteration of the Business course, this is too small a sample to provide a firm conclusion.

The topic of group selection did not feature in any discussion noted in the wikis for forums. Following up in the student interviews, the topic elicited only one response. . A Business student deliberately chose to change groups between iterations of the collaborative activity to avoid working with a certain colleague. Otherwise, the students did not prefer one method or the other.

Note, the course teams expected all groups to function because both the students are post-graduates. Therefore, we may surmise that at this level, that the course teams' expectations about the students were reasonable.

Collaboration through sharing experience

The Computing course intended the students to share their experience of the new materials learnt in the course, whereas the Business course intended the students to share the experience they brought from outside the course.

These intentions were realised, with examples presented in Chapter 7 to show that the students did share the intended experiences. Therefore, in this research we have an example of wikis being used in collaborative activities to support different forms of shared experience, be it drawing on the Computing students' *new* experiences or drawing on the Business students' *old* experiences. Therefore, this research can report observations of a wiki supporting different forms of shared experience among students when used in an appropriately designed collaborative activity.

9.5 Updates to the courses since this research

Updates to the Computing course

The Computing course is still (2010) in presentation at the OU. The Computing course materials have undergone a major change since this research. This was due to the adoption of a new edition of the set book, which incorporated several new elements, and the inclusion of agile development methodologies. However, the collaborative activities remain broadly the same and are:

- A minimalist ice-breaker, with the wiki used for students to briefly introduce themselves and assume of the role of one of the stakeholders in the case study that runs through all of the activities. The one change to the activity is for the students to use forums to plan the subsequent activities and agree deadlines. This requires discussion, which is more effectively conducted outside the wiki. The change repeats the research finding that the wiki was not used for project planning, and hence argues caution in adopting Farrell's proposed use of a wiki in software engineering within a course (Farrell, 2006).

- The second activity still requires the students to define requirements based on a case study. The course team provide students with a template for the requirements, which is used by the students in a variety of ways and not always as intended by the course team. In addition, the students are now given a sample requirement, and are only required to contribute two requirements of their own instead of three requirements without a sample to work from. The students are expected to refine the requirements to remove duplicates and eliminate ambiguities as before.

- The final activity was for the students to provide metrics, *fit criteria*, for the requirements. Due to time pressure, this activity was dropped from the course, but the end of course examination results showed that the students did not know the topic so well. Therefore, the course team re-introduced the activity, though this time with a model against which the students define fit criteria. The students comment on each other's fit criteria and finally update their own criteria. The assignment requires the students to post both their original and their final criteria supported with comments on how the criteria changed between these versions.

The course requires that the students are post-graduates and are expected to be responsible for their own actions. The tutors highlight the course timetable to the students and let the students organise themselves through the first activity.

In forums and in contacts with tutors, there are now no student complaints about workload. The course team attribute two reasons for this change: the planning exercise in the first activity, and the reduction in workload.

The role of the tutor has not changed. Formally the tutor does not take part in the collaborative activities. However, the course team reports that the tutors do monitor their students' progress, and intervene to encourage contributions were necessary.

The changes described in this sub-section are in line with the guidelines. The wiki is supplemented with a dedicated discussion tool, and the students are provided with sufficient guidance to be immediately productive. The changes made by the course team are based on their practical experience delivering the course, on student feedback, their own research[15] and review of the research findings with the researcher. Those aspects of the course that have not changed, such as the sufficiency of a minimalist ice-breaker to enable group formation, are also in line with the guidelines.

That the features that changed and did not change match the guidelines suggests a pragmatic validity to the guidelines. However, none of course team decisions for the course were made as a direct consequence of the guidelines. Rather the guidelines confirmed the course team's plans for the course by providing an independent validation of the decisions. These reviews have continued with the current course chair who took over after the data gathering for this research was complete. Hence, there is scope for a more formal validation of the guidelines as a piece of future research when the course is replaced.[16]

Updates to the Business course

The Business course is still (2010) in presentation at the OU.

The structure of the collaborative activities remains the same. The activities are a short ice-breaker followed by two iterations of a collaboratively authored report on a contemporary management issue. However, the collaborative authoring tasks have been reduced to only one week each in duration. In part this was done to relieve some of the time pressures within the course. Equally, the course team made this change to

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[15] The data gathered in this research was also used by the course team for their own research. Further, having arranged this research's Online tools survey, the opportunity was taken by the course team to elicit student views on other tools, eg podcasts, that might be added to future presentations of the course.

[16] The last presentation of the Computing course is expected to start in November 2013.

increase the time pressure within the activity. Due to the limited time available to write the report, the students now pay heed to the course team's directions that emphasises content over presentation. The course team's intention is to teach their students how to conduct research on management issues, not how to write reports.

Since this research was completed, the OU VLE wiki has been enhanced and now includes support for embedded images among its additional features. Hence, some of the frustrations reported by the Business students in this research when their ambition for the report exceeded the wiki's capabilities should no longer apply. The course team are aware of other collaborative authoring tools, and have looked at Google Docs, which offer a relatively rich feature set compared to the wiki studied in this research. However, making use of the additional features goes against the course team's intentions that the students should focus on a management issue and not be distracted by report presentation. Therefore, the course team have kept the wiki because they wish to have the students produce a web-based document, and have amended their course guides to communicate better the course's intended learning outcomes and learning opportunities. This choice was informed by reviews of the guidelines developed in this research with the course team. Of particular interest to the course team was the inappropriateness of Wikipedia as the primary example of a wiki.

The Business course team were also influenced by the general feedback provided by this research. The post-presentation interviews were of especial interest to them because of the change in views reported by many students as they reflected on the course without the time pressure to deliver TMAs. One student had been vociferous in her complaints during the course, as seen in forum posts and discussion with the tutor; however, in the interview she admitted that now she could:

> *"see what they [the course team] were getting at." [BS10 interview]*

This encouraged the course team to persist with the course and its wiki-enabled collaborative activities.

The wiki is still supplemented by the VLE forum for student discussion.

Assessment remains the prime motivation for student engagement. Groups are still awarded a common mark for the wiki content, and a personal mark for reflecting on how the management issue could affect their workplace.

The Business students in general still do not use wikis at work, though the course team notes that each year, the new cohort of students is more aware of wikis than the previous one.

The changes described in this sub-section are in line with the guidelines. The principal change being to set students' expectations to match the abilities of the wiki and the needs of the activity. The changes made by the course team are based on their practical experience of delivering the course, on student feedback and on discussion of the research findings with the researcher. All changes match the guidelines, whether derived directly from them or considered independently by the course team. Similarly, those aspects that have not changed, such as the sufficiency of a minimalist ice-breaker to enable group formation, are also in line with the guidelines. This supports on a pragmatic level the applicability of the findings of this research.

9.6 Updates to the wiki since data gathering was completed

The VLE wiki has been enhanced with new features since the data gathering in this research. However, the collaborative activities in the courses remain primarily text based and so do not use the new features. The course teams have opted to follow the wiki philosophy of simplicity, and constrained the collaborative activities accordingly.

One new feature could benefit students and address a problem reported in this research that students did not know when the wiki had been updated.

The use of RSS

In this research the students addressed their concern about knowing when the wiki had been updated mainly through use of e-mail. There is, however, a technical solution to the problem.

Really Simple Syndication (RSS) is a mechanism by which people can 'subscribe' to the wiki and be automatically informed when there is a change. To address the issue of updates, the OU VLE wiki has been enhanced to offer an RSS feed to subscribers. However, follow up interviews with the course teams indicate that it has not addressed the students' concern.

The OU's RSS implementation reports updates at wiki level, not page level. In other words, all updates are reported, regardless of where they are in the wiki, and regardless of whether they are of interest to the subscriber or not. Also, the update messages are not informative. They are generic texts stating that *so-and-so* has updated the wiki, but do not indicate what sort of update has been made.

In the Computing course, the course team reports that few of the students avail themselves of RSS. In the Business course, the course team reports none of their students use the RSS feed, though the course chair does subscribe to RSS to monitor progress with the collaborative activities.

In both courses, a pragmatic rule-based approach by the students for notification of wiki updates remains successfully in place.

9.7 Areas for future research

The research drew on data gathered during and after the course presentations. As noted there was the occasional discrepancy in the views expressed by students, sometimes even by the same student, between these two data gathering exercises. The different sources strengthen the findings of the current research because of the different views they provide on the wiki and the activity, both when under the pressure to deliver against the course timetable, and later when able to reflect on the course as a whole. The discrepancies could merit further research because in other contexts the timing of data gathering could more radically alter the findings.

A repeat of this research drawing on other domains could explore if the simple distinction between computing and non-computing students is valid, or if further sub-divisions of the student population are required.

The research could also be repeated to investigate the effect of tutor intervention in the student activities. Tutor intervention might be one effective means of delivering the sample rules and wiki structures to the students and ensure they are used consistently as intended by the course team.

Future research could also investigate the affect of appointing a chair to manage the student discussions. The role did not exist within the groups studied in this research. However, several students commented that such a role might have benefited their groups' work by making the discussions more effective, and reach a conclusion more quickly.

This research set out to investigate if a simple wiki could enable collaborative learning. The research could be extended to consider the effect of a more sophisticated wiki. There is an active debate about the possibilities for learning support through wikis with a richer feature set. This research contributes to that debate by stating that feature-rich wikis are not necessary to enable collaborative learning activities. One option is to repeat this research with courses that have collaborative activities exploiting a feature-rich wiki and see if similar results emerge. A second option is to apply the results of this research to those courses and record student and tutor feedback on the applicability of the guidelines.

9.8 Conclusion

This work is distinguished from earlier research into using wikis in education because it is an in-depth, multi-data empirical study. The research for the most part validates the findings of the smaller scale studies. The resultant guidelines, therefore, often repeat existing suggestions, but can do so more authoritatively. However, two of the guidelines consistently provoke further discussion: the relatively limited need for socialisation, and the role of the audit trail. These two guidelines in particular may be considered to contribute to the discourse on the use of wikis to support collaborative learning in distance-education.

Abbreviations

AODM	Activity Oriented Design Method
AT	Activity Theory
B857	B857 Current Issues in Public Management and Social Enterprise
CRC	Centre for Research in Computing
CSCW	Computer Support for Collaborative Work
CMC	Computer Mediated Communication
DP	Data Protection
ECA	End of Course Assignment
eTMA	electronic Tutor Marked Assignment
GT	Grounded Theory
HPMEC	Human Participants and Materials Ethics Committee
IET	Institute of Educational Technology
JISC	Joint Information Systems Committee
M883	M883 Software requirements for business systems
MPA	Master of Public Administration
OU	Open University
RE	Requirements Engineering

SPSS	Statistical Package for the Social Sciences
SRPP	Student Research Project Panel
TMA	Tutor Marked Assignment
VLE	Virtual Learning Environment

Glossary

Action	In Activity Theory, activities are composed of goal directed actions.
Activity	The unit of analysis in Activity Theory, in which an activity is directed at an object to realise an outcome. This outcome is what motivates the activity: without a motivation there is no activity.
Activity Centred Design	Represents a move Is the result of applying Activity Theory to Computer Supported Collaborative Learning, See Gifford and Enyedy, 1999.
Activity Theory	A theory of socially-situated and artefact-mediated human activity. The constituents of activity are not fixed, but can dynamically change as conditions change.
Blended learning	An approach to teaching and learning that combines face-to-face and computer-mediated methods and materials.
Blog	A user created website, written in a journal style. Posts are displayed in reverse chronological order, and can be made available to others for comment. As such it is not a collaborative tool, but rather a means of communication directed by an individual.
Collaboration	Individuals working together to create an artefact. This does not mean that the individuals will have a shared understanding of the jointly created artefact.
Collaborative Blog	A collaborative blog is a blog in which posts can be written by more than one author. Each post is owned by its author. Readers can comment on the post, they cannot edit it. Most collaborative blogs centre on a single uniting theme, such as politics or technology.

Collaborative Editor	A collaborative editor is an application that allows several people to edit a document from different computers. Typically these make use of the internet to access the remote documents via a web browser.
Collaborative Learning	Joint work by a group of students who, in creating a product, search for understanding and meaning in the developing their product, which means they have the potential to learn together.
Computer Supported Collaborative Learning	CSCL is the application of computers to support collaborative learning. It was first derived from the application of industry's Computer Supported Collaborative Work tools, such Lotus Notes and Microsoft Exchange, to education. CSCL supports group work by enabling users to share and communicate ideas, information, resources and artefacts.
Computer Supported Collaborative Working	A generic term covering how people work in groups enabled by computer technology.
Constructivism	Pedagogical theory in which the learner constructs their own knowledge. Therefore, all knowledge is personal knowledge shaped by the learner's feelings and experience. Concept derived from work by Piaget and Vygotsky on children's cognitive development.
Content Management System	A computer based collection of procedures and tools used to manage work flow in a collaborative environment to allow for a large number of people to contribute to and to share stored data.

Cooperative Learning	Similar to collaborative learning, but the common task is more prescriptive meaning that it can be broken down into component parts that can be developed by the individual group members. Thus there is less opportunity for dialogue among the students as the end product may be the combination of their individual contributions rather than result of their joint endeavours.
Dialogue	Used in the educational sense as a conversation with intent. The intention is for all participants to be open in the dialogue and not seek to use debating tactics or power and influence to win the argument. Through open exploration, the participants can achieve understanding of the topic that is the focus of the dialogue. Dialogue can be with a 'more knowledgeable other', with peers, or with self. The common theme is to debate various viewpoints, with reference to what is already known, so as to produce an understanding of the topic of the dialogue. There is no dialogue without a topic. In this research, external dialogue is referred to as discourse and internal dialogue as reflection.
Distance education	The delivery of teaching and learning to students who are not physically "on site" in a traditional classroom or campus.
E-Delivery	The simplest form of e-learning, in which the learning materials are made available to students through electronic means. The technology is used simply to provide a repository of the learning materials.
E-Learning	E-learning is the delivery of learning materials and opportunities through electronic means. It can involve a variety of media — including CD-ROMs, video and audio tapes, and websites — and encompasses both online courses and multimedia applications.

Ethics Approval	In the OU all research is subject to ethical approval. The primary body for this process is the 'Human Participants and Materials Ethics Committee (HPMEC)', supplemented by the 'Student Research Project Panel (SRPP)' should the research involve OU students.
Group Blog	See 'Collaborative Blog'.
Groupware	Software that can be used by a group of people who are working on the same information but may be distributed in space. Groupware is the software that enables Computer Supported Cooperative Work (CSCW) q.v.
Human Participants and Materials Ethics Committee	An OU body that reviews all research applications to ensure that contemporary ethical standards are adhered to.
Knowledge	The product of learning, the personal creation of the learner. This follows Vygotsky's socio-constructivist definition of the term, in which learning is an active process of constructing knowledge assisted by social interaction, rather than a passive acquiring of knowledge.
More Knowledgeable Other	Term devised by Vygotsky. Originally intended to define the relationship between a parent and child. Use extended for any discussion between a relative expert and a learner, be it formal such as between a tutor and a student, or informal such as between students one of whom has more relevant experience than the other(s).
Online Tools	Refers to software accessed over the internet, so that the files and applications are hosted remotely rather than on the user's computer.

Operations	In Activity Theory, operations implement actions. Operations do not have their own goals
RSS	Really Simple Syndication is a web technology that publishes updates of websites to interested users.
Socialisation	As defined by Salmon, and forming the second step in her Five Step Model, it is through socialisation that a student is motivated to exploit the e-learning tool knowing that they are part of a larger community of learners.
Socio-Constructivist	Extension to constructivist ideas by Bruner, building on the importance attached to dialogue by Vygostky. Emphasises the social aspect of constructing ideas, because students rarely learn in isolation.
Social Software	Social software encompasses a range of software systems that allow users to interact and share data, specifically social sites like MySpace and Facebook, and media sites like Flickr and YouTube. Frequently social sites make use of a wiki to provide editable web pages.
Student Research Project Panel	An OU body that vets research applications that involve OU students. The Panel's primary purpose is to co-ordinate research across the university so that students are not over-surveyed and researchers do not overlap in their demands. Only students approved by the SRPP may be approached to participate in research.

Virtual Learning Environment	A software system designed to support teaching and learning in an educational setting. Normally working over the Internet, the VLE provides a collection of tools some directly involved in teaching such as support for assessment and communication, as well as indirect tasks such as administration and course enrolment. VLEs can be used to support both distance education (q.v.) and blended learning (q.v.).
Wiki	A website that allows the creation and editing of any number of interlinked web pages via a web browser. Any user can create and edit any page, and provide links to another page within the wiki. Thus, a wiki can be used as a collaborative authoring tool. This is in contrast to a blog, which has only one master author.

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Appendix 3.1 The standard Open University end of course student survey

Course overall

*Please tick **one** circle per statement only.*

	Definitely agree	Mostly agree	Neither agree nor disagree	Mostly disagree	Definitely disagree	Not applicable/ used	FOR OFFICE USE ONLY
The course met my expectations.	○	○	○	○	○	○	(85)
Overall, I was satisfied with the teaching materials provided on this course. (For example, printed text, CD ROMs, DVDs, online materials.)	○	○	○	○	○	○	(86)
I enjoyed studying this course.	○	○	○	○	○	○	(87)
I was satisfied with the support provided by my tutor/study adviser on this course.	○	○	○	○	○	○	(88)
I would recommend this course to other students.	○	○	○	○	○	○	(89)
The course met its stated learning outcomes.	○	○	○	○	○	○	(90)
The course provided good value for money.	○	○	○	○	○	○	(91)
Overall, I am satisfied with my study experience.	○	○	○	○	○	○	(92)
Overall, I am satisfied with the quality of this course.	○	○	○	○	○	○	(93)

What was the most positive aspect of studying this course?

What was the most negative aspect of studying this course?

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It is always very useful to illustrate the survey findings in our internal reports and external publications with anonymous quotes from your comments. *Please tick the circle if you would rather your comments were not used in this way.* ○ (94)

Thank you for participating in this survey. We plan to contact some students to learn more about their experiences. Would you be happy to participate in a follow up study? Yes ○ No ○ (95)

If YES, please write in your e-mail address so we can contact you.

Thank you for participating in this survey. Please return the questionnaire as soon as possible using the reply paid envelope to: FREEPOST ANG 5175, The Survey Office, Institute of Educational Technology, The Open University, MILTON KEYNES, MK7 6YR, UK.

Data Protection Information
The data you provide will be used for research purposes and the raw data will be seen and processed only by The Open University staff and its agents. This project is administered under the OU's general data protection policy guidelines, which can be seen here: http://www3.open.ac.uk/our-student-policies/pdf/dataprotection.pdf

Institute of
Educational Technology

The Open University

Autumn 2006 Courses Survey

Please use **dark blue** or **black biro** to complete the survey and tell us your thoughts on the course shown above. Please tick **one** circle **only** for each question or statement unless otherwise stated on the form. If you make a mistake and tick the wrong circle, please block out your answer and then tick the correct circle. ● ✓ ○ ○

Motivation and Expectations

What were your reasons for studying with the OU?
*For this question **only,** tick **all** the reasons that applied to you.*

		FOR OFFICE USE ONLY
For personal development.	○	(22)
To help me progress or change my current career.	○	(23)
For intrinsic subject interest.	○	(24)
As a hobby/leisure interest.	○	(25)
To find out if I could cope with study at this level.	○	(26)

What were your reasons for studying this particular course?
*Tick **one** circle only.*

As part of a programme of study to achieve an OU qualification.	○	(27)
As a one-off course with no intention of future OU study.	○	
Aiming to take more OU courses but undecided on qualification.	○	
As preparation for study elsewhere.	○	

How accurate was the information and advice you received about:
*Tick **one** circle only per row.*

	Very	Fairly	Not very	Not at all	Not used	
Course choice information in OU publications or OU websites.	○	○	○	○	○	(28)
Advice and guidance on course choice from an OU member of staff.	○	○	○	○	○	(29)
Information for students with disabilities or specific learning difficulties.	○	○	○	○	○	(30)
The order in which you might study OU courses to gain a qualification.	○	○	○	○	○	(31)
Career information, advice and guidance related to your course.	○	○	○	○	○	(32)

Computers and the Internet

Did you have access to the following for OU study purposes?
*Tick **one** circle only per row.*

	Yes, all of the time	Yes, most of the time	Yes, occasionally	No, never	
A computer.	○	○	○	○	(33)
A broadband internet connection.	○	○	○	○	(34)
A dial-up internet connection.	○	○	○	○	(35)

Workload

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Overall, approximately how many hours per week did you expect to study this course including completing assignments and participating in conferencing and tutorials?

0-4	5-8	9-12	13-16	17-20	21-24	25+	
○	○	○	○	○	○	○	(36)

Overall, approximately how many hours per week did you actually study this course including completing assignments and participating in conferencing and tutorials?

0-4	5-8	9-12	13-16	17-20	21-24	25+	
○	○	○	○	○	○	○	(37)

Overall, was the total amount of time you spent studying as you expected?

A lot less than expected	A little less than expected	About as expected	A little more than expected	A lot more than expected	
○	○	○	○	○	(38)

Which month(s) had the heaviest workload? *Please tick **all** circles that apply.*

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	None in particular	
○	○	○	○	○	○	○	○	○	○	○	○	○	(39-51)

Was there a TMA that you found particularly difficult? *Please write your answer in the boxes given.*

For example: 0 2 *Your answer:* ☐☐ *Or tick here if no TMA was particularly difficult* ○ (52-54)

Your study environment and managing your studies

*Please tick **one** circle per statement only.*

	Definitely agree	Mostly agree	Neither agree nor disagree	Mostly disagree	Definitely disagree	Not applicable/used	
I was able to find a suitable place to study.	○	○	○	○	○	○	(55)
The study guide(s) provided useful support.	○	○	○	○	○	○	(56)
I was able to access online activities at the time I needed to.	○	○	○	○	○	○	(57)
The course calendar helped me to plan my studies.	○	○	○	○	○	○	(58)
I was able to keep up to date with the schedule in the course calendar.	○	○	○	○	○	○	(59)
I was able to meet the assignment deadlines.	○	○	○	○	○	○	(60)
I used the study break/reading week built into my course to catch up on my studies.	○	○	○	○	○	○	(61)
The course was more difficult than I expected.	○	○	○	○	○	○	(62)
It was easy to contact my tutor/study adviser.	○	○	○	○	○	○	(63)
I had enough contact with other students on my course.	○	○	○	○	○	○	(64)
I received encouragement from colleagues/friends/family for my studies.	○	○	○	○	○	○	(65)

Teaching material, assessment and feedback

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*Please tick **one** circle per statement only.*

	Definitely agree	Mostly agree	Neither agree nor disagree	Mostly disagree	Definitely disagree	Not applicable/used	
The printed teaching materials helped me to learn effectively.	○	○	○	○	○	○	(66)
The DVD/CD materials helped me to learn effectively.	○	○	○	○	○	○	(67)
The online elements in the course helped me to learn effectively.	○	○	○	○	○	○	(68)
The range and blend of teaching materials enhanced my learning. (For example, printed text, CD ROMs, DVDs, online materials.)	○	○	○	○	○	○	(69)
The breadth of the course was too wide to study it all in sufficient detail.	○	○	○	○	○	○	(70)
The pace of the course was about right.	○	○	○	○	○	○	(71)
I had time to study some of the optional material provided on the course.	○	○	○	○	○	○	(72)
I was selective in the material I studied on this course.	○	○	○	○	○	○	(73)
I had a clear understanding of the standards required in my assessed work.	○	○	○	○	○	○	(74)
The assessment activities during the course allowed me to demonstrate what I had learnt.	○	○	○	○	○	○	(75)
The final end of course assessment/examination allowed me to demonstrate what I had learnt.	○	○	○	○	○	○	(76)
The library's online resources enhanced my study.	○	○	○	○	○	○	(77)

Please add below any further comments about your teaching materials, assessment or feedback.

Study Support

*Please tick **one** circle per statement only.*

	Definitely agree	Mostly agree	Neither agree nor disagree	Mostly disagree	Definitely disagree	Not applicable/used	
I received constructive feedback from my tutor/study adviser on my assessed work.	○	○	○	○	○	○	(78)
Feedback on assessed work from my tutor/study adviser was always prompt.	○	○	○	○	○	○	(79)
I was satisfied with the quality of the face-to-face tutorials I attended.	○	○	○	○	○	○	(80)
I was satisfied with the quality of the online tutorials I took part in.	○	○	○	○	○	○	(81)
I was satisfied with the quality of the one to one email dialogues I had with my tutor/study adviser.	○	○	○	○	○	○	(82)
I was satisfied with the quality of the phone tutorials I took part in.	○	○	○	○	○	○	(83)
I received satisfactory support for study relating to my disability or specific learning difficulty.	○	○	○	○	○	○	(84)

Appendix 3.2 The Computing course end of course student survey

M883 Online Tools Survey

This questionnaire is intended to elicit your views on the suitability of the online tools used to support M883. Were they useful to your study, and how might they be improved? We are partcularly interested in your opinion of wikis for supporting M883's collaborative activities, and the usefulness of wikis for supporting (a) the Requirements Engineering process and (b) the learning of Requirements Engineering concepts. Please answer the following questions from your own experience on M883.

1. I found the wiki to be an effective tool for supporting my input to the collaborative activity.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

2. I found the wiki to be an effective tool for enabling my group members to respond to my input in the collaborative activity.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

3. I understood why a collaborative activity was an essential part of the course.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

4. I did not see the point of a collaborative activity in this course.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

5. I thought the collaborative activity was an essential part of the course.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

6. I can see why a wiki was used to support the collaborative activity in the course.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

7. I found the wiki a useful tool to share the tasks in the collaborative activity.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

8. I found the wiki a useful tool to schedule the tasks in the collaborative activity.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

9. I found the wiki a useful tool for writing the requirements developed in the collaborative activity.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

10. I found the wiki a useful tool to discuss the requirements developed in the collaborative activity with my group members.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

11. I found the wiki a useful tool to help me modify the requirements in the collaborative activity.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

12. I found the wiki a useful tool to help me reflect on the collaborative activity.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

13. I found the wiki helped me plan and share the work with the group members.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

14. I found the wiki helped me share my ideas with the group members.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

15. I found using the wiki helped me have a constructive dialogue with the group members.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

16. I found the wiki helped me improve my understanding of the Requirements Engineering process.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

17. I found the wiki helped me improve my understanding of the benefits of collaboration in the Requirements Engineering process.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

18. I found the wiki helped me take part in the task of writing the requirements.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

19. I have improved my understanding of the potential application of wikis in Requirements Engineering.
(Please select one only)

○ Definitely agree ○ Mostly agree ○ Neither agree nor disagree ○ Mostly disagree ○ Definitely disagree

20. Based on your experience on this course, provide examples of whether or not the wiki was a useful tool for you to:

*** learn Requirements Engineering concepts by sharing and developing ideas with others.**
*** work through the Requirements Engineering process with others, conducting the activity itself.**
*** jointly author a Requirements document, from capturing the initial draft through recording modifications.**

Please specify:

21. Did you use any other online tools to complete the collaborative activity? If so, what did you use, at which stage(s) and why?

Please specify:

22. Whether or not you used other online tools, are there features and facilities that could be added to the wiki to facilitate the collaborative activity and, thereby, improve your learning experience?

Please specify:

23. What was the most positive aspect of using the wiki?

Please specify:

24. What was the most negative aspect of using the wiki?

Please specify:

Online Quizzes

25. Did you attempt any of the Quizzes?
(Please select one only)

- ○ Yes
- ○ No - Please go to Q28

26. If you did attempt them, how helpful were the Quizzes in your study?
(Please select one only)

○ Very helpful ○ Helpful ○ Not helpful ○ Not at all helpful

27. If you did attempt them, at which stage(s) of the study did you use the Quizzes? And why?

Please specify:

28. In what ways do you think the Quizzes could be improved?

Please specify:

Requirements Recording Tool

29. At which stage(s) of your study on the course did you use the Requirements Recording Tool? And why?

Please specify:

30. Do you have any suggestions as to how the Requirements Recording Tool could be improved?

Please specify:

Seminars by Experts on the DVD

31. At which stage(s) of your study on the course did you listen or view the seminars on the CD and/or read the transcripts? Answer 'None' if you did not use this resource.

Please specify:

32. Did you find the seminars useful to your study? If so, how? Or, if they were not useful, please say why.

Please specify:

We are thinking about introducing podcasts into M883

33. In what ways do you think that course-related podcasts can improve the learning experience of M883?

Please specify:

34. Suggest topics in the course (e.g. quality gateway, use cases, and so on) or other aspects (e.g. stories of experiences on 'real' requirements projects by experts) that would benefit from being presented as podcasts and say why you think these would be good choices.

Please specify:

Thank you for taking the time to complete this questionnaire.

Please submit your responses by clicking on the button below.

Submit

If you have any technical problems accessing or submitting this questionnaire please email: The OU ELSA Team.

Appendix 3.3 Development of data gathering tools

This appendix describes the development of the data gathering tools identified in Chapter 3: the questions set to students in the Computing course, the interview protocols and the end of course surveys

Computing course student questions

This research makes use of an innovative form of survey which ensures an almost 100% response rate among students who complete the course. The survey questions were incorporated into the summative assessment of the course.

Among the intended learning outcomes for students, the Computing course team wanted them to know about the RE process and how it can be facilitated by wikis as is increasingly happening in industry. This gave scope for including questions on the students' use of wikis in the assessments.

The development of the questions was carried out in parallel with the introduction of the collaborative learning activities into the Computing course. The researcher worked closely with the course team both to develop the questions and the collaborative activities themselves, in addition to supporting documentation such as a course specific wiki guide for the students.

The crucial aspect of the questions for the success of this research was that students had to relate their experience of using the wiki in the course to their understanding of the RE process. This meant they could gain marks by making a valid comment about the role of a wiki, but would gain more marks if they could then show an example of this from their own experience using the contents of a wiki in the course to justify their comment.

One issue with this approach, compared to other survey techniques, is that it is not possible to pilot the questions. Therefore, the questions were subjected to scrutiny by the researcher and course team before being added to the assessments.

Computing course end of course survey

The OU's Institute of Educational Technology (IET) Student Statistics Team ran their standard end of course survey at the end of the first Computing course presentation that included the collaborative activities. This meant that a research specific survey could not be run, as that would lead to the students being subjected to too many surveys.

The IET end of course survey is run across a broad sample of OU courses to gain general feedback for the course teams and the OU on the courses. The first part of the survey is a series of closed questions and pseudo-Likert questions relevant to the OU, for example, "What were your reasons for studying with the OU?" The students were also asked about their attitudes towards the accessibility of the online activities, which was relevant to this study. Also useful were the final open questions where the students could leave comments on three topics:

1. Their course materials, assessment and feedback
2. The most positive aspect of the course
3. The most negative aspect of the course.

This survey, though not conducted by the researcher nor conducted directly on behalf of this study, has provided valuable extra data to inform the analysis of student attitudes to the course and its online tools.

Computing course-online tools survey

The second presentation of the Computing course studied in this research did not include an IET sponsored end of course survey. This meant there was the opportunity for a course specific survey. The Computing course team was interested in running a survey of the online tools used in the course and this was combined with questions on wiki use to further the current research.

The elements of the survey relevant to this research made use of pseudo-Likert questions to provide simple metrics relating to aspects of the research questions as well as open questions to elicit reasons and motivations. The survey was developed through several iterations of discussion with the course team and piloted with two members of the Computing course team.

The live survey was administered by IET, which avoided many of the problems associated with delivering an online survey. IET also provided the initial analysis of the data, collating and summarising the responses to the pseudo-Likert questions in an Excel spreadsheet and the collating the answers to the open questions in a Word document.

Interview protocols

The development of the interview protocols proceeded in parallel with the development of the Computing course online tools survey. The intention was to avoid unnecessary duplication, and to ensure that the possibilities afforded by an interview for extracting extra information, especially student motivation, were met. The protocols were developed through several iterations with the Computing course team. The tutor interview protocol was piloted with a Computing course tutor who was also the Computing-course's FirstClass discussion moderator. The student interviews were piloted with two Computing course students who were also OU tutors on other courses.

The protocols above were designed for face-to-face interviews. Once completed, versions for telephone and e-mail interviews were adapted from them.

The interview protocols for the Business course tutors and students were developed in parallel with those for the Computing course. Using the Activity Oriented Design Method analysis of the differences between the two courses helped guide the different emphasis in each survey to reflect the differences in the:

- context of the activity
- description of the activity
- description of the report to be written
- role of the tutor
- use of forums for discussion in place of the wiki.

Sample interview protocols are included as Appendix 3.5 to this dissertation.

Appendix 3.4 Implementation of data gathering tools

This appendix describes the data gathering processes following their approval by the several OU ethics committees described in Chapter 3. The appendix sets out the issues that relate to the accuracy, effectiveness and efficacy of the processes. There were several obstacles to the efficient gathering of data, which are discussed here. It is also noted that while two of the obstacles slowed progress on the research, they also had unintended benefits.

Course team interview recruitment

The Computing and Business course teams had given their consent to be interviewed as part of the ethics approval process as they had to give their written consent to the research. Two members of the each course team were interviewed, with follow up sessions to clarify certain matters. All were face-to-face interviews conducted on-site at Walton Hall, the headquarters of the Open University.

Tutor interview recruitment

In the Computing course, the researcher sent e-mail requests to all tutors. Six of the seven tutors were interviewed. Three interviews were face-to-face interviews conducted at the OU's Walton Hall site. The remainder were telephone interviews.

The Business course team chair asked the two course tutors directly if they would be interviewed; both agreed and were interviewed by telephone.

Student interview recruitment

E-mails were sent out to all SRPP identified eligible students asking for volunteers using the SRPP approved text. It was necessary to repeat the request three times to recruit a statically significant number of students. In addition, specific students from this group, identified as particularly active in using the wiki from the VLE's statistics, were sent individual e-mails by the researcher.

The two Business course tutors sent e-mails to eligible students asking for volunteers. This was repeated twice. Again, specific students identified as particularly active in using the wiki from the VLE's statistics, and confirmed as eligible, were sent individual e-mails by the researcher.

An issue identified in Fielding and Lee, 1993, and in Sapsford and Jupp, 1996, is the possibility of bias through interviewing 'enthusiasts' only. However, the wording of the invitation was carefully phrased to minimise this risk, and the subsequent interviews showed that this had been successful.

For both courses, snowballing was used to augment the numbers interviewed, i.e. interviewees were asked at the end of their interview if they could recommend others who could be approached for interview. This led to many leads, of which only one was met with outright rejection. However, most of the others continually rescheduled and ultimately declined to be interviewed if they had initially agreed to a telephone interview, or did not return the interview script if they had agreed to an e-mail interview. The interviewer had used snowball recruitment in previous research with more success. Its limited effect on this occasion was probably due to the closed number of students. Any student approached through 'snowballing' would have already been invited to participate in the original e-mail. Therefore, a further personal call to take part was not refused so as not to give offence, but was nevertheless not taken up.

Interview process

All interviews were arranged by e-mail. The preparatory e-mail exchange included sending the interviewee a consent form. The consent form includes a pre-amble describing the research. For e-mail interviews, the consent form had to be acknowledged before the e-mail interview was sent to the interviewee. For telephone interviews, the consent form had to be acknowledged before conducting the interview. For face-to-face interviews, the consent form was reviewed and collected as part of the introduction to the interview. The interview process is described in the next section.

Interview preparation

Before a student was interviewed, their wiki contributions, forum posts, and TMA and examination answers were consulted as appropriate to note behaviours to follow up in the interview. As the interviews progressed, the pre-interview check was extended to see if other group members had already been interviewed and if so, whether there was anything relevant to follow up in this interview.

A similar preparation process was followed before interviewing tutors. Their groups' wikis and forum posts were examined looking for discussions and issues to follow up in the interview. As the interviews progressed, a check was also made to determine if any of their students had been interviewed already and whether there was anything relevant from those interviews to follow up in this interview. For the Business course, all student interviews were completed before interviewing the two course tutors.

Post-interview tasks

All interviews were recorded. Immediately on completing the interview the audio recording was backed up. The interview log was updated and any immediate reflections on the interview noted accordingly. The next day a follow up e-mail was sent to the interviewee thanking them again for their contribution to the research.

Wikis

Using privileged access to the VLE, the wikis were extracted using the administrator's export utility. This produced a zip file supposedly containing the content of the selected wiki. Unfortunately, there was a problem in the version of Moodle used in the VLE at the time. Only the first page of the wiki and those immediately linked to it were included in the export. Therefore, rather than the extraction being an automatic process, time was required to check each wiki export for completeness. When missing pages were identified, they were individually downloaded and manually edited to be added to the exported version of the wiki website. However, this manual process had the advantage that each wiki website had to be examined in detail and so the researcher gained an early insight into their structure, style and content.

There was a second minor problem with the exported wiki pages. Each displayable page has a 'code page' associated with it. This defines the character set that the browser should use to display the page. The exported wiki has a different code page to the online version. This resulted in characters such as 'curly quotes' being displayed incorrectly. The online page would display them correctly, however, the exported version that did not recognise the character codes, displayed the underlying codes instead. This was beneficial because the presence of these codes suggested when a student had prepared their contribution using an editor other than the VLE wiki editor. The VLE wiki editor used before February 2007 did not support such codes as 'curly quotes', while the version after that date would allow the entry of such codes only through additional work by the students. In contrast, word processors, such as Microsoft Word, can apply 'curly quotes' automatically. Thus, the presence of these codes suggested that the interview should include questions on the choice of editor used by the student.

This meant that while there were two problems in extracting data from the VLE, both of which slowed progress, a consequence of both problems was to aid informal analysis of the wiki content.

Forums

For discussions relating to matters other than the requirements specifications being written in the wiki, the OU's standard asynchronous online tool, FirstClass, was used. Unfortunately, the OU had withdrawn the offline client for FirstClass, so that it was not possible to download these conferences. Therefore, 'snapshots' were made of the screens showing the flow of the discussion threads, and relevant items manually downloaded.

The Business course used the VLE forum for its students' discussions so that all work relating to the course would be within the VLE. There was no export utility for VLE forums. Therefore, the forums were extracted using the Mozilla Firefox add-on Scrapbook. This add-on is designed to aid researchers capture web data. The extracted forums were then re-exported from Scrapbook as HTML pages into a folder to be available for review and analysis.

Computing course assessments

There was no recruitment issue associated with gathering this data because all students have to produce assessments as part of their course.

The researcher was granted access to the assessment system as a tutor. This enabled the researcher to download submitted assessments, which were then stored in encrypted folders.

Computing course examination scripts

There were no recruitment issues associated with gathering this data because all students have to produce examination scripts as part of their course.

The researcher was granted access to the examination scripts. The scripts are only made available once the period for student appeals had passed. Therefore, the first presentation scripts were collected for analysis in October 2007, and the second in May 2008.

Computing course first presentation end of course survey

This survey was administered by IET with no direct involvement by the researcher. 72 eligible students were surveyed of whom 41 responded, a response rate of 56.9%.

Computing course second presentation online tools survey

IET administered the survey. Of the 95 students on the course 63 were identified by the SRPP as eligible for further involvement with this research. Of those, 20 completed the survey, giving a response rate of 31.7%.

Quantitative data

The OU VLE is based on Moodle. Moodle records all accesses to all resources. The wiki and forum access records were downloaded by the researcher, in addition to accesses to supporting materials, such as Course and Wiki Guides. These records document the resource accessed, when, by whom, from where and the type of access (read, edit, etc.)

There were problems extracting the data from the version of Moodle then in use by the OU. After much investigation, including working with Moodle's developers in Australia, the problems were identified as a bug within the filter routines in the software. The bug has been fixed in later versions of Moodle. However, for this research it meant that all Moodle logs had to be downloaded for processing, and then subjected to data cleansing taking several days effort for each download before being usable in this research.

There were two types of data cleansing required. The first was to eliminate errors. There were two types of error. The first was the existence of spurious tabs in the output data which had to be removed. Tabs are used to delimit columns. Any additional tabs meant that the data would not align correctly when imported into Excel for analysis. Some entries seemed to have additional tabs for no discernable reason. In other cases, a reason could be identified which made correction much easier. For example, some users had a tab within their username. The second type of error was corrupt records, usually of the form that two original records were interleaved as one record. The second type of data cleansing was to identify to which group's wiki website the record referred. This was derived from the user id in the record.

Student marks

The assessment marks were available to the researcher when downloading assessments answers from the assessment system. The examination script marks were available to the researcher when reading the marked scripts.

Appendix 3.5 Sample interview protocols

Computing Course Student E-Mail Questionnaire

To Study
The Effectiveness of Wikis
to Enable Collaborative Learning

Prepared by David King
Contact Details:
✉ d.j.king@open.ac.uk
☎ 01908 858306

Introduction

This e-mail questionnaire is intended to elicit your views on the use of wiki in M883-07E. I am particularly interested in your opinion of wikis for supporting M883's collaborative activities, and the usefulness of wikis for supporting (a) the Requirements Engineering (RE) process and (b) the learning of Requirements Engineering concepts.

This interview complements the more general online survey of M883's Online Tools in which you may have been asked to participate. This e-mail interview addresses different aspects of the tools used to support M883 to those covered in the online survey.

Please answer the following questions from your own experience on M883.

The interview is in three parts. The first looks at the wiki as a tool, the second at the collaborative activities, and the third at the learning of the RE process."

First Part – wiki as tool

"A wiki is a special type of web site that allows anyone from a browser to add, edit or delete pages in it. The changes can be tracked through the wiki's history, and anyone can act as an administrator to restore an earlier version of a wiki page."

1) In what ways, if any, was the wiki a suitable tool for you to interact with your group?

Considering the wiki as a tool, did using it:

2) influence your willingness to participate in the collaborative work?

3) help you feel part of the group?

4) influence the way the group worked, or did not work, together?

5) In what ways, if any, was the wiki an efficient tool for you to collate requirements with your group?

6) In what ways, if any, was the wiki a helpful tool for you to share your progress in understanding of RE and RE concepts with your group?

7) Could the wiki, as a tool, be changed to support the above uses?

Second Part – collaborative activities using the wiki

"M883 included collaborative activities in which you worked with the other members of a small group to produce some of the elements of a requirements specification. A wiki was used to enable you to collaboratively create, refine and document requirements."

8) What, if any, challenges did you face taking part in the collaborative activities?

9) What, if any, challenges did you face in collaborative authoring?

10) In what ways, if any, did the use of a wiki, affect the work of the group in refining the requirements during TMA2?

11) What if anything, went wrong with the collaborative activities? Could they have been changed to address any issues identified?

Third Part - collaborative learning of the RE process

"The wiki included discussion pages. These could be used to comment on each others contributions to the document as part of the collaborative activity and help the group refine the requirements. They could also be used to discuss course concepts as applied in the collaborative activity, giving the opportunity to learn collaboratively as well as work collaboratively."

12) What, if anything, did you learn through the collaborative activities that you might not have learned about RE without them?

13) Your learning of which, if any, specific concepts of RE and aspects of the RE process did you feel you benefited from the two TMAs that used the wiki?

14) How did you feel your group members progressed in their understanding of RE and RE concepts over the two TMAs as demonstrated in the collaborative activities?

15) In what ways, if any, did you use the wiki after the completion of the collaborative activity?

Thank you for your time in completing this e-mail interview.

May I contact you again if I have further questions for clarification?

If you have any further questions of me, or would like to be kept informed of the results of my research, then please contact me.

Computing Course Tutor Face-to-Face Interview Protocol

To Study
The Effectiveness of Wikis to Enable Collaborative Learning

Prepared by David King, PID X6436849
Contact Details: ✉☐ d.j.king@open.ac.uk,☎ 01908 858306

Pre-interview
1. Introduction, based on consent form:
- "I'm a PhD student looking at wikis…"
- "This research aims to look at the effectiveness of wikis especially in supporting collaborative learning…"
2. Consent Form: Ensure they have a copy in front of them (sent earlier) & that they understand it:
- means this is an OU approved study
- has also been subject to ethical & Data Protection review and approval
- the interview itself will last about half-an-hour, depends on discussion
- and will be recorded, unless strongly object
- data will be anonymous
- consent can be withdrawn at any time during project, i.e. planned PhD submission Dec '08, & their contribution removed from the study
- SIGN & return the form, or e-mail consent at least, if not already done so

Background questions - profiling

1) About the tutor:
    Have you tutored other OU courses?
    Have the other courses involved group work?
    Are you involved in group work in your daily job?
    If yes:
    What tools do you use? (what tools did you use if retired?)
    What challenges do you face?
    If in education:
        How do you assess your students' group work?
        How does face-to-face group work compare with online group work?
    Have you used a wiki before? If yes, then what for?

2) About the changes:
    What were your first thoughts on hearing that a wiki was to be included in the course?
    What were your expectations as to the changes would affect you?
    What were your expectations as to how the changes would affect your students' experience?
    Did you feel the collaborative activity was an add-on or an integral part of the course?
    Did you have any concerns about the collaborative activity?

Did you have any concerns about the wiki?

Interview Introduction

“This will be a semi-structured interview to allow exploration of your perceptions of your groups’ use of the wiki in M883. I have looked at your groups’ wikis and FirstClass conference threads. However, I do not have access to any other communication between you and your students.

As we go through the interview can you think of evidence and examples to illustrate your answers? I may ask that you forward these examples to me afterwards – anonymised as necessary.

The interview is in three parts. The first looks at the wiki as a tool, the second on the collaborative activities, and the third on the learning of the RE process.”

First Part – wiki as tool

“A wiki is a special type of web site that allows anyone from a browser to add, edit or delete pages in it. The changes can be tracked through the wiki’s history, and anyone can act as an administrator to restore an earlier version of a wiki page.”

3) In what ways, if any, was the wiki a suitable tool for your students to work as a group?

Considering the wiki as a tool, did using it:

4) influence your students’ willingness to participate in the collaborative work? How?

5) help your students’ feel part of a group? How?

6) influence the way your students’ groups worked, or did not work, together? How?

7) In what ways, if any, was the wiki an effective tool for your students to write a document as a group?

8) In what ways, if any, was the wiki an effective tool for your students to share their progress in understanding of Requirements Engineering concepts in their groups?

9) Could the wiki, as a tool, have been changed to support any of these uses?

Supplementary questions as required:

A) Did the students supplement the wiki with other tools? If so, what and why?

B) Was the wiki usable:

- usability
- collaborative work
- support to the students

If not, then in what ways? What queries did the students raise about these issues.

C) What were the group dynamics and did they change during the presentation? Always assuming the group was able to work as a team at all!
Did the role of the wiki change as group passed through the [usual] life cycle of forming, then not too storming, and then norming?

Second Part – collaborative activities using the wiki

"M883 included collaborative activities in which your students worked with the other members of a small group to produce some of the elements of a requirements specification. A wiki was used to enable them to collaboratively create, refine and document requirements."

10) What, if any, challenges did they report facing when engaged in the collaborative activities?

11) What, if any, challenges did they report facing when engaged in collaborative authoring?

12) What was your role in the collaborative activity?

D) How were you involved? Could you give me examples of when you intervened? What kind of interventions did you make?

13) Could the collaborative activities set in the wiki have been changed to address any issues identified?

Supplementary questions as required:

E) Document's structure further – having reviewed against student's group wiki contents before the interview

Depending on wiki ask how the student's group decided to use or not use the following features and whether the decision, on reflection, was a good one: especially use/non-use of provided structure & requirements template

Page format:

Use of formatting

Sub-division of pages

Influence of any of these features on the collaborative authoring

Familiarity of student with hypertext style of document against conventional prose document

F) Explore groups' organisations - having reviewed against apparent organisation from student's group wiki statistics

Role of tutor: is one step removed, not a direct member of the group or a moderator of the activity, but did they serve as an escalation point?

Did you feel your students were adopting differing roles?

Was there a formal structure? Definition of roles such as author, editor, etc.

Was there an informal structure? People assumed certain roles/profiles.

How did the organisation emerge?

Was the wiki used to help create the organisation within the group?

Did any such division influence the process of writing?

G) Personal experience:

Any involvement in this wiki, or other wikis?

Was it easy for you to review the wiki content, if you had so to do?

Third Part - collaborative learning of the RE process

"The wiki included discussion pages. These could be used to comment on each others contributions to the document as part of the collaborative activity and help the group refine the requirements. They could also be used to discuss course concepts as applied in the collaborative activity, giving the opportunity to learn collaboratively as well as work collaboratively."

14) What aspects of the group activities set using the wiki do you think enhanced your students' learning experience of RE?

15) In communications with you, did your students report use of the wiki to discuss their progress in understanding of RE and RE concepts?

16) In communications with you, did your students report using the contributions from others in their group to progress their understanding of RE and RE concepts when using the wiki?

17) In communications with you, did your students report any ways in which they used the wiki after the collaborative activity to progress their understanding of RE and RE concepts?

Supplementary questions as required:

H) Did the wiki seem to provide a space to discuss the meaning of any specific terms/phrases in the requirements, any other aspect of the course, such as RE concepts, or the intended learning outcomes?

I) Were there other factors identified by your students to you, within the group for example, which inhibited sharing ideas?

J) Did your students report that the wiki facilitated reflection on their own, and others', contributions?

And

18) At the end of the presentation did you have the same concerns about the wiki as you had at the beginning?

K) How did it go?

Was it an extra burden? Bearing in mind that they weren't involved day-to-day, but still students had to escalate problems to them, especially because the activity was linked to the TMA.
Did it match their expectations?
How did it compare over 06K and 07E – was the second presentation 'better' at addressing their concerns and 'better' in supporting the students' learning.

19) Have you any questions for me?

Post-interview

Debrief interviewee:

- Can they suggest suitable students for interview to help with my research? And could they, or should I, make the request of them?
- Remind them to send e-mails & other supporting evidence as discussed during the interview.
- Next step is for me to transcribe, i.e. summarise key points & only write out supporting quotes in full – can I ask them further questions for clarification if necessary?

- They can contact me at any time, confirm they have my details from Consent Form, or my supervisor
- thank them!

Once telephone call ended:

- backup interview recordings
- update interview log
- reflect on interview – anything particularly memorable, methodological difficulties or successes, etc.

Busniess Course Student Face-to-Face Interview Protocol

To Study
The Effectiveness of Wikis to Enable Collaborative Learning

Prepared by David King, PID X6436849
Contact Details: ✉ d.j.king@open.ac.uk, ☎ 01908 858306

Pre-interview

1. Introduction, based on consent form:
- "I'm a PhD student looking at wikis…"
- "This research aims to look at the effectiveness of wikis especially in supporting collaborative learning…"
2. Consent Form: Ensure they have a copy in front of them (sent earlier) & that they understand it:
- means this is an OU approved study
- has also been subject to ethical & Data Protection review and approval
- the interview itself will last about half-an-hour, depends on discussion
- and will be recorded, unless strongly object
- data will be anonymous
- consent can be withdrawn at any time during project, i.e. planned PhD submission Dec '08, & their contribution removed from the study
- SIGN & return the form, or e-mail consent at least, if not already done so

Background questions

1) About the student:

Have you studied other OU courses?
Have the other courses involved group work?
Is the student involved in group work of this style in their daily job?
Have they used a wiki before? If yes, then what for?

2) Has the student completed the online survey?

If yes then:
Do they have anything to add to the survey?
If no then:
Then ask them to do it, explaining it does cover other material.

Interview Introduction

"This will be a semi-structured interview to allow exploration of your feelings in response to your groups as well as your own use of the wiki. The interview is in three parts. The first looks at the wiki as a tool, the second on the collaborative activities, and the third on the learning of the management research process."

First Part – wiki as tool

"A wiki is a special type of web site that allows anyone from a browser to add, edit or delete pages in it. The changes can be tracked through the wiki's history, and anyone can act as an administrator to restore an earlier version of a wiki page."

3) In what ways, if any, was the wiki a helpful tool for you to work with your group?

Considering the wiki as a tool, did using it:

4) influence your willingness to participate in the collaborative work?

5) help you feel part of the group?

6) influence the way the group worked, or did not work, together?

7) In what ways, if any, was the wiki an efficient tool for you to write the report with your group?

8) In what ways, if any, was the wiki a helpful tool for you to share your progress in understanding of the chosen research topic with your group?

9) Could the wiki, as a tool, have been changed to support any of the above uses?

Supplementary questions as required:

A) Did you supplement the wiki with other tools? If so, what and why?
Interviewee should mention the Forum – especially in response to Q8.

B) Was the wiki usable? If not, then in what ways?

C) Did the role of the wiki change as group passed through the usual life cycle of forming, then storming, and finally norming?

Second Part – collaborative activities using the wiki

"B857 included collaborative activities in which you worked with the other members of a small group to produce a report on a chosen management topic. A wiki was used to enable you to collaboratively create and refine the report."

10) What, if any, challenges did you face in engaging in the collaborative activities?

11) What, if any, challenges did you face in collaborative authoring?

12) In what ways, if any, did the use of a wiki, affect the work of the group in refining the report?

13) What if anything, went wrong with the collaborative activities? Could they have been changed to address any issues identified?

Supplementary questions as required:

D) If necessary, explore the document's structure further – having reviewed against student's group wiki contents before the interview

Depending on wiki ask how the student's group decided to use or not use the following features and whether the decision, on reflection, was a good one :
Document structure:
relative navigation among pages
maintaining version history
location of discussion (seperate pages or as footnotes)
Page format:
Use of formatting
Sub-divide pages
Influence of any of these features on the collaborative authoring
Familiarity of student with hypertext style of document against conventional prose document

E) Explore the group's organisation - having reviewed against apparent organisation from student's group wiki statistics

Was there a formal structure? Definition of roles such as author, editor, etc.
Was there an informal structure? People assumed certain roles/profiles.
How did the organisation and the individual roles emerge?
To what extent was your tutor active in the group?
Was the wiki used to help create the organisation within the group?
Did any such division influence the process of writing?

F) Personal experience:

Were you willing to contribute to the wiki?
Were you willing to modify and restructure other contributions in the wiki?
Was it easy to make the changes you wanted in the wiki?
Was it easy to find you way around the wiki (and get to elements you wanted to change)?

Third Part - collaborative learning of the management research process

"The wiki was supported by a forum to enable discussion. This discussion could cover comments on each others contributions to the report as part of the collaborative activity and so help the group refine the report. The forum could also be used to discuss course concepts as applied in the collaborative activity, giving the opportunity to learn collaboratively as well as work collaboratively."

14) What, if anything, were you able to learn through the collaborative activities that you might not have learnt otherwise about your research topics and researching management policy?

15) How did you feel your group members progressed in their understanding of the research topics and researching management policy over the two TMAs' collaborative activities?

16) How did you feel you progressed in your understanding of the research topics and researching management policy over the two TMAs' collaborative activities?

17) In what ways, if any, did you refer to the wiki to help you review and reflect upon your progress in understanding of the research topics and researching management policy over the two TMAs' collaborative aactivities?

Supplementary questions as required:

G) How did using the forum work alongside the wiki? Could the discussions be matched up to the content, for example? Was it successful having two tools, one for each type of task within the activity?

H) Were there other factors, within the group for example, which inhibited sharing ideas?

I) Did the wiki facilitate reflection on their, and others', contributions? Did the forum facilitate reflection on their, and others', contributions? How did the two tools compare for supporting reflection?

And

O) Have you any questions for me?

Post-interview

Debrief interviewee:

- next step is for me to transcribe data, i.e. summarise key points & only write out supporting quotes in full – can I ask them further questions for clarification if necessary?
- they can contact me at any time, confirm have my details from Consent Form, or my supervisor
- thank them!

Once telephone call ended:

- backup interview recordings
- update interview log
- reflect on interview – anything particularly memorable, methodological difficulties or successes, etc.

Appendix 3.6 Emergent qualitative analysis codes

This appendix records the emergent codes identified during the qualitative analysis of the interview, assignment and examination answers.

Positive aspects of wiki use

collaborate

geographically apart

time apart (do not have to come together for whatever reason at the same time to work, i.e. project benefit)

in own time (explicitly stakeholder work at own convenience, i.e. personal benefit)

at any time

different working patterns

updated at any time

unlimited numbers

different depts

central repository

can comment/review

consensus

internal links

traceability

interactions fully recorded

dynamic, easy to add content

time for reflection

anonymous

up-to-date view

usable by non-technical staff

identify missing reqs

identify conflicting reqs

help in completeness & correctness of reqs

easy to use

no need for training

can limit access to group members

can express different views/perspectives

not need special software on client machines

version/source control

for initial thoughts/elicitation stage

for later stages/clarification

only need internet connection (c/f negative comment: 'computer & internet dependent')

accessible (in the 'get at' sense, not the usability sense)

self documenting

low technical barrier of entry

enable teamwork (and teamwork good in RE because can call on wide ranging expertise)

democratic

all public/visible

terminological meaning can be made standard

low cost

overcomes public fears

can suggest silly ideas

blame free environment

encourage involvement

informal exchange of information

can get quick response

available for re-use

Negative as pects of wiki use

all public/visible (concern this may not be appropriate - sensitive information)

no support f2f/interaction

no support synch discussion

unstructured

can need prompting to use

no security (open to all comers)

no workflow (especially to confirm end/closure/agreement)

computer & internet dependent

discussion flow difficult (especially as get longer)

training needed

costly to set up & maintain

terminological meaning not standard

offline discussion not visible to all users

time intervals between contribs

edit lock = one user at a time

need other tools

need other methods

need goodwill of participants

lacks spontaneity

needs administration (of wiki content, not the wiki itself)

can be hard to use

changes are not tracked(?)

no versioning existed(?)

poor traceability

much better tools on the market (such as?)

psychological technology barrier

cannot brainstorm

not support images

history pages poor for traceability

afraid to enter silly suggestions

open to misunderstanding

all users equal (but are not equal in roles & authority)

need offline/private discussion space

cannot see when others are looking

not fit in with non-electronic tools

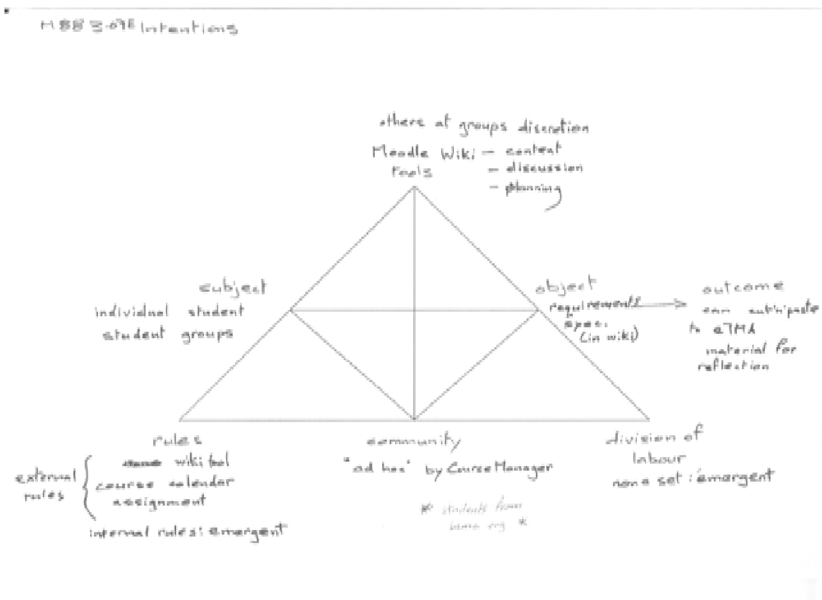
can be incomplete

Appendix 4.1 Using Activity Theory to elicit course team intentions

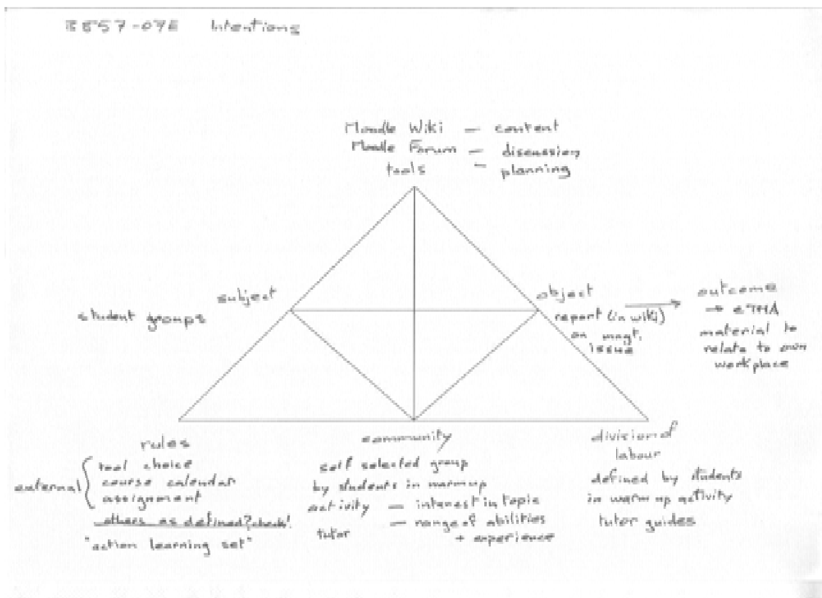
Hand drawn Activity Theory diagrams

The following hand drawn Activity Theory diagrams were produced during the interviews with the course teams to elicit their design intentions for the collaborative activities. They are reproduced as Figures 4-2 and 4-3 in the main text.

The Computing course



The Business course



Appendix 4.2 Computing course reflection template

This appendix is a direct copy, hence the different formats, of the reflection template supplied on the Computing course to assist students reflect on the course and their learning.

Reflection: Keeping a Journal

Process of reflection

Reflection is a strategy that facilitates learning through re-examination and re-interpretation of experience. It is central to effective learning and development. Experience on its own does not guarantee learning. It is the process of reflecting personally on your own experience that helps you to acquire deeper insight. Reflection may be prompted by positive experiences, such as undertaking a difficult task successfully, or by negative experiences, such as loss of confidence, embarrassment or disillusionment. You may find the process of reflection uncomfortable: it can be difficult and might mean confronting difficult or painful issues. However, you can gain much from reflection in terms of personal and professional growth.

A reflective practitioner (Schon 1983) is a person who constantly reflects on his or her actions and takes new actions in the light of that reflection – an autonomous, self-aware, self-directed person who can use whatever happens for learning and growth. For example, being a reflective practitioner involves continually checking on how well a technique, activity or a tool is working, and finding ways to improve it – *mistakes can be a resource rather than a deficiency*. Doing something, reflecting on what happens, taking new action in the light of that reflection, and repeating the process, is continual learning process. Reflection can also act as a catalyst for triggering creativity (Ghosh, 2003). Creativity involves the ability to produce original and ingenious solutions to problems[17].

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[17] Analysis of the circumstances leading to profound scientific discoveries and engineering inventions throughout history reveals a familiar pattern. While attempting to solve an unknown challenging problem, a scientist or engineer first exhaustively explores every known principle and technique. While there are no known mechanisms to assess the thoroughness of the search, the fact that a single creative discovery often consumes the inventor's entire life and that the percentage of inventors is miniscule appears to indicate that their efforts are near exhaustive. After all attempts fail, the individual engages in deep contemplation for a period of time, that may vary considerably, at the end of which an innovative solution drops, literally, from somewhere onto the individual's mind. The most famous example is the classical story of Archimedes who, while deeply immersed in thinking of a solution to determine the purity of a gold ornament during his bath, was suddenly struck by the answer that we now understand as Archimedes' principle.

The process of reflection is one of posing and answering questions. "Asking questions facilitates the process of reflection" (Johns, 1994).

Asking questions

To help you get started, the *reflection template* included below contains a few questions to guide the process of capturing your experiences, feelings, and opinions while you are working through the course, and especially on the collaborative activities (wiki). These questions are just 'triggers' or 'probes' to make you think about the various elements of M883 as you work through the course. You will notice that some questions are repeated across the template to help capture how your experiences and views change as the course progresses. While you don't need to answer all the questions, there could be other issues that you might like to record and which are not covered by this reflection template.

Recording your experiences, feelings and opinions

You should record your thoughts in a journal as you work through the course to record what you feel *at the time*. It does not matter what device you use to record your thoughts: you can use the Personal Journal tool on the course website, paper, or any word processor. Simply record your thoughts and views at the time and then, at the end of the course see how your thoughts/views have changed as the result of your experiences. In addition to reflecting while you are working through the course and the TMAs, the revision-time after the TMA03 and before the exam might be a good time to reflect on your overall experience on the course. Your journal is for your own record and should remain private to you unless you decide to reveal its contents to others.

Reflection template

In the reflection template, the questions are arranged in three groups, one for each of the TMAs. The first group aims to guide the recording of your feelings (frustration, relief, satisfaction, contentment, and so on) while working through the course and the collaborative activities. The second group aims to capture your opinions or views on the collaborative development of a requirements specification. The third group is about capturing your experiences of using the wiki tool that has been provided to facilitate the collaborative activities. We suggest that you begin by copying the questions from this template and pasting them into your journal. Then simply add brief notes about your experiences, feelings, and opinions for these questions and/or any other thoughts while you are working through the course and taking part in the collaborative activities.

The template suggested in this document is just one approach to reflecting through a set of questions and you are, of course, welcome to devise your own self-reflection process.

Reflection in TMAs

- In TMA01, you will be asked to reflect on our experiences in a particular situation. For attempting the TMA01 question, sufficient information is provided in the TMA question itself. However, the template below suggests that you should record some reflections at the TMA01 stage which will enable you to answer the questions related to reflection in TMA02 and TMA03.
- In TMA02, you will be asked to report your reflections on the collaboration in the wiki environment.
- In TMA03, you will be asked to reflect on your learning through your study on M883 and whether the process of reflection during the course helped (or hindered) your learning.

Remember, the notes in your journal are your own personal thoughts and are intended to be for your own benefit, not for sharing with others. However, when you are asked, in TMA02 and TMA03 to reflect back on your experiences, you may wish to include some extracts from your journal or you may prefer to provide a more thoughtful response based on your notes.

References

Ghosh, S. (2003) "Triggering Creativity in Science and Engineering: Reflection as a Catalyst", Journal of Intelligent and Robotic Systems, Volume 38, Nos. 3-4, pp. 255-275.

Johns, C. (1994) "Nuances of reflection", *Journal of Clinical Nursing*, vol. 3, pp. 71-75.

Schon, D. (1983) The Reflective Practitioner – How Professionals Think in Action, London, Temple Smith.

Some other sources that you might find helpful to learn more about reflection:

"Question and fostering understanding", http://www.infed.org/foundations/understanding.htm, website last accessed: 16 May, 2007.

"Reflection" http://www.infed.org/biblio/b-reflect.htm, website last accessed 16 May, 2007.

Suggestions for questions at the TMA 01 stage

Yourself

- What expectations do you have of the course? Why are you doing this course? What you want to get out of the course?
- Is the structure of the course clear? Do you have a clear understanding of what is expected of you?
- Are you looking forward to or do you have anxieties about the collaborative activities on the course?
- Do you feel that collaborative work on this course will provide you transferable skills for the industry or your work-place?

Collaboration in Requirements Engineering (RE)

- How confident are you about the wiki activity for TMA 01?
- How have you found the experience of using the wiki?

Wiki as a tool

- Is the introductory material[18] sufficient for you to get started with the wiki-activity?
- How easy has it been to access the wiki?
- How easy is the wiki to use?

Suggestions for questions at the TMA 02 stage

Yourself

- What are your feelings about collaborating on the wiki-activity for TMA02?
- Are you learning something specific from others about RE theory and practice?
- What aspects of the collaboration help/hinder your progress?
- Are your expectations about the course being met with what you have read in the course and encountered so far?
- Are there any course concepts that were unclear first and which became clearer as you have progressed through the course and the two TMAs?

[18] Documents being referred to here are available on the course website: 'How to use a wiki on M883?' and 'Moodle wiki: User's guide'.

- If you are involved with RE at your work-place, do you think that the course will help improve or alter your RE practice?
- Are there any aspects of the course that could be applied in other areas of work, for example in situations of change management or when analysing any problems facing a business or organisation?

Collaboration in RE

- Is it easy or difficult to understand the wiki-activity for TMA 02?
- How are you organising the wiki activity with your fellow students in the pre-TMA02-submission stage?
- How easy or difficult is it to find and resolve ambiguities, dependencies and conflicts between requirements when working collaboratively at a distance and asynchronously (different location and different time)?
- How easy or difficult is it to agree on a final set of requirements at the end of the pre-TMA02 collaboration?
- How is your group deciding on a process for arriving at an agreement over the answer for TMA 02? (For example, has anyone suggested an approach which would help you all to reach agreement)

Wiki as a tool

- Are you using the discussion-page in the wiki for capturing your group's discussions? Are you capturing the rationale of your decisions on the discussion page?
- Are you using any other tools to schedule the wiki activities and the associated milestones? What purposes do the other tools serve?
- Are you using any other tools to aid your discussions in the group? What purposes do the other tools serve?
- Are you using any other tools to develop your contributions before posting them in the wiki? If you are, what purposes do the other tools serve?
- Have you found the wiki to be a useful tool for collaborative development of a set of requirements and then a requirements specification? What limitations (if any) do you think there are to the wiki's usefulness?

Suggestions for questions at the TMA 03 stage

You will be asked to report your reflections on M883 in TMA03. An important element of reflection in TMA 03 will be to look at your notes/reflections and evaluate how your thoughts have changed and developed as you have worked through the course materials and exercises. To help with this process, we have listed some additional questions below that should enable you to reflect on your expectations, experiences, feelings and opinions/views which you will have recorded in your journal.

- Think about your experiences on the course and compare them with the expectations outlined in your journal at the time of TMA01? Were your expectations met?

- Do you feel that collaborative work on this course has provided you with transferable skills for use in your work-place? What are these skills?
- Which concepts of the course became clearer as you progressed through the course?
- Overall how do you feel about the collaborative work using the wiki? Has it enhanced your learning on this course?
- Would you like to suggest any new' or additional topics that could be introduced in the course? Is there anything we could leave out to fit this 'new' suggested material?
- If you are involved with RE of software systems at your work-place, do you think that the course will change your RE practice?
- Are there any aspects of the course that could be applied in other areas of work, for example in situations of change management or when analysing any problems facing a business or organisation?
- Have any aspects of the RE theory or practice surprised you?
- Has reflection been useful? Has reflection helped you to evaluate your experiences?
- Has reflection helped you to understand what you have learned on the course? Will you use reflection again in other learning activities?
- How useful was the reflection template to prompt your reflective thinking?

Appendix 4.3 Summary of Business course students' views on collaborative working

After completing the first collaborative activity, the Business course students reformed their tutor groups for an online wiki-enabled 'tutorial' to discuss and reflect upon the activity. The pre-amble to the exercise from the tutors read: "Initially I would like you to each record below one thing about they way your learning set worked that you commend to your colleagues and one thing that with hindsight you would do differently. I have started the lists with my main general observation."

BT1 tutor group

Commend

1. Spirit of cooperation.
2. Respect for the contribution of others/different experiences.
3. Appreciate the different requirements of life/families/jobs of others, resulting in different working styles.
4. Rallying round to deliver to deadline.
5. Combined help with formulating question/ structure of report.
6. Agreeing a structured timetable.
7. Agreed individual question areas for individuals to complete on behalf of group & trusted individuals to complete them.
8. Document control maintained/managed.
9. Valuable comments from team re improving sections of the report, and suggesting research that might help.
10. Team members progressing the project while I was on holiday.
11. Commenting with helpful advice on others contributions.
12. The tremendous support from other members within the group.

Change

1. Clarity of roles
2. More communication about timelines, so that everybody in the group knows where the others approximately are in terms of contributions.
3. Identify any potential non-delivery sooner rather than later.
4. Prepare a draft report at least a week (?) before submission to allow adequate time for review.
5. Choosing a proposal quickly.

6. Maintain word system for report and not focus on Wiki population until end of report production process. (Jxxxx) I did this for the final editing, but I still had formatting problems when I transferred to the wiki, although this could be my inexperience!
7. Reduce time spent surfing/research the net for diverse information sources (Jxxxx) I agree. I spent way too long trawling through numerous documents linked to my section, and ended up only useful a few once I drilled down to the core issues. (Pxxxx) I felt that this area of work was time consuming although we did share Google search references within our group - as each member was responsible for different areas of the report - it meant that we all had a lot of Google searching to do for our allotted area.
8. Make sure to cover everything in the TMA question during initial planning stages.
9. Being able to slot into the wiki diagrams in line with the flow of text.

BT2 tutor group

Commend

1. Spirit of cooperation.
2. A strong collaborative group can make short work of the project, people got stuck in and met the deadlines.
3. The group's ability to manage its time and workload to within heavy studying and working commitments.
4. Ability and willingness to take the initiative.
5. There was a team spirit even though we did not know each other.
6. The group's quick adaptability when something did not go to plan or someone was not available.
7. Agree with [6] - the group adapted well and was able to reach agreement quickly to ensure the report moved forward and we kept to schedule.
8. Willingness of the editor to take responsibility for ensuring the content and style of report was consistent.

Change

1. Clarity of roles.
2. Strengthening the 'added value' of collaborative learning i.e. we did not share enough of our own experiences and collectively learn from others as much as we might.
3. If you have someone in the group who does not pull their weight you have little choice but to do more work to cover this (or feel frustrated at their coasting).
4. It takes one person to really edit the wiki and this can be an onerous task - better to be more focused to start with.
5. Allocate blocks of text to draft to each other rather than piecemeal sections.

6. Use case studies or other examples to bring the report alive and more relevant.
7. More stringency on word count needed when sections were being completed, to reduce the words for editing.
8. More in depth discussion at the beginning regarding the topic, where we agree or disagree and the slant the report will take.
9. It was fairly difficult to agree the content of the report at first, but once title was agreed the report flowed from that.
10. Difficulty in maintaining consistency of style and approach when different members are writing different sections.
11. Agree with [10]'s observation, once individual sections were written little comment was made on each others contribution or suggested revision of the report, which was in effect left to one individual s sterling efforts. Which suggests we need to be more prepared to share areas of writing and agree how to rewrite each others submissions.